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# A web-based monitoring and evaluation system for government projects in Tanzania: a case of health projects

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**A WEB-BASED MONITORING AND EVALUTION SYSTEM FOR  
GOVERNMENT PROJECTS IN TANZANIA : A CASE OF HEALTH  
PROJECTS**

**Mpawe Nicodem Mleke**

**A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of  
Master's in Information and Communication Science and Engineering of the Nelson  
Mandela African Institution of Science and Technology**

**Arusha, Tanzania**

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## **ABSTRACT**

Monitoring and evaluation system is used across the world by organizations or governments to measure, track progress and evaluate outcomes of programs. Organizations can improve their performance, effectiveness and achieving results in programs success by strengthening their monitoring and evaluation systems. Moreover, various studies reveal the need for information and communication technology systems in monitoring and evaluation activities. Despite the advantage of the tools, most organization does not employ computerized monitoring and evaluation systems due to cost of the systems, limited expertise and those having these systems lack a systematic early alert mechanism of the programs progress.

Currently, the Ministry of Health, Community Development, Gender, Elderly and Children of Tanzania monitors and evaluates its programs manually, due to this; they face the risks and challenges of delayed projects completeness. Monitoring and evaluation staff spent a lot of time in manual work, delay in submission of data, data is lost between primary registries to monthly summaries, from monthly to quarterly summaries, lack of having project details, project status, timely adoption and remedial action.

In this study, data were collected by using document reviews, focus group discussions and interviews to generate system requirements. A web-based monitoring and evaluation system for the ministry of health projects were developed to solve the monitoring and evaluation challenges, to provide timely, simplify works, generate quality data effective planning and successful project implementation. Lastly, the developed system was tested and evaluated against the user's requirements and was positively accepted to be deployed at the ministry of health.

## DECLARATION

I, Mpawe N. Mleke, do hereby declare to the Senate of Nelson Mandela African Institution of Science and Technology that this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

.....

Mpawe N. Mleke

.....

Date

Name and Signature of the candidate

The above declaration is confirmed by:

.....

Dr. Mussa A. Dida

.....

Date

Name and Signature of the Supervisor

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## **CERTIFICATION**

I, the undersigned certify that I have read and hereby recommends for acceptance by The Nelson Mandela African Institution of Science and Technology, a dissertation entitled, “A Web-based Monitoring and Evaluation System for Government Projects: A Case of Health Project” in partial fulfillment of the requirements for award of the degree of Master’s in Information and Communication Science and Engineering.

.....

Dr. Mussa A. Dida

.....

Date

Name and signature of Supervisor

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## **DEDICATION**

I heartily dedicate this work to my beloved parents Mr. Nicodem Mleke and Mrs. Mekisna Hamis for their dedicated time and encouragement during my entire course of study.



## TABLE OF CONTENTS

ABSTRACT.....	i
DECLARATION .....	ii
COPYRIGHT.....	iii
CERTIFICATION .....	iv
ACKNOWLEDGMENT.....	v
DEDICATION.....	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES .....	x
LIST OF FIGURE.....	xi
LIST OF APPENDICES .....	xii
LIST OF ABBREVIATIONS AND SYMBOLS.....	xiii
CHAPTER ONE .....	1
INTRODUCTION .....	1
1.1 Background of the Problem.....	1
1.2 Statement of the Problem .....	2
1.3 Rationale of the Study .....	3
1.4 Objectives of Study .....	4
1.4.1 Main Objective.....	4
1.4.2 Specific Objectives .....	4
1.5 Research Questions .....	4
1.6 Significance of the Study .....	4
1.7 Delineation of the Study.....	5
CHAPTER TWO .....	6
2.1 Project Monitoring and Evaluation .....	6
2.2 Importance of Monitoring and Evaluation .....	6
2.3 Monitoring and Evaluation System.....	7
2.4 Tools and Techniques for Effective Monitoring and Evaluation.....	7
2.5 The Strength of the Monitoring Team and Project Success.....	7
2.6 Related Study on Monitoring and Evaluation System .....	7
CHAPTER THREE .....	11

MATERIALS AND METHODS.....	11
3.1 Research Case Study Area .....	11
3.2 Sample Size and Technique .....	11
3.3 Data Collection Methods.....	11
3.3.1 Document Review.....	11
3.3.2 Interview .....	12
3.3.3 Focus Group Discussion .....	12
3.4 Data Analysis Method.....	12
3.5 Requirement Analysis .....	12
3.5.1 Functional Requirements .....	13
3.5.2 Nonfunctional Requirements .....	14
3.6 Conceptual Design .....	15
3.7 Use Case Diagram.....	17
3.8 Data Flow Diagram .....	18
3.9 Database Schema.....	20
3.10 Module Development Approach .....	21
3.11 Tools and Technologies Used in System Implementation .....	22
3.12 System Testing and Validation.....	24
3.12.1 Unit Testing .....	24
3.12.2 Integration Testing.....	25
3.12.3 System Testing.....	25
3.12.4 User Acceptance Testing .....	25
CHAPTER FOUR.....	26
RESULT AND DISCUSSION .....	26
4.1 Results From Data Collection.....	26
4.1.1 The Result From the Focus Group Discussion .....	26
4.1.2 Result from Interview .....	27
4.1.3 Results from Document Review .....	28
4.2 The Developed Web Application for Government Projects at the Ministry of Health in Tanzania.....	28
4.2.1 Account Section.....	30

4.2.2	Settings Section .....	31
4.2.3	Project Detail Section .....	34
4.2.4	Project Implementation Section.....	38
4.2.5	Project Monitoring and Evaluation System Reports Section .....	41
4.2.6	System Log .....	43
4.3	System Testing Results .....	45
4.4	User Acceptance Testing Results.....	45
4.5	Discussion .....	48
CHAPTER FIVE .....		49
CONCLUSION AND RECOMMENDATIONS .....		49
5.1	Conclusion .....	49
5.2	Recommendations.....	49
REFERENCES .....		50
APPENDICES.....		56
RESEARCH OUTPUT .....		66

## **LIST OF TABLES**

Table 1:	Functional requirements for the proposed system.....	14
Table 2:	Nonfunctional requirement for the proposed system .....	15
Table 3:	System testing results .....	45
Table 4:	The system's user acceptance validation result.....	47

## LIST OF FIGURES

Figure 1:	The designed solution for proposed system .....	17
Figure 2:	Use case diagram.....	18
Figure 3:	Context diagram .....	19
Figure 4:	Data flow diagram.....	20
Figure 5:	Database schema .....	21
Figure 6:	Evolutionary prototyping methodology .....	22
Figure 7:	Present the current system on how they monitor and evaluate the government project at the ministry of health in Tanzania.....	27
Figure 8:	Login interface .....	29
Figure 9:	Dashboard.....	30
Figure 10:	Account setting.....	31
Figure 11:	Position panel and functionalities .....	32
Figure 12:	List of users with user management functionalities .....	32
Figure 13:	Add user page.....	33
Figure 14:	Member panel with its functionalities .....	34
Figure 15:	Edit member information form .....	34
Figure 16:	Page for entering project details.....	35
Figure 17:	Project sponsor details form.....	36
Figure 18:	Shows the project member form .....	36
Figure 19:	Project activities form .....	37
Figure 20:	Form for project report uploading.....	38
Figure 21:	Form for indicator setting.....	39
Figure 22:	Form for entering indicator achievement .....	39
Figure 23:	Activity budget setting .....	40
Figure 24:	Activity Expenditure entering .....	40
Figure 25:	Form for uploading activity execution attachment .....	41
Figure 26:	Page for downloading project report.....	42
Figure 27:	The indicator performance for a project activity.....	43
Figure 28:	The PMES log record history.....	44
Figure 29:	The log replacement functionalities .....	44

## **LIST OF APPENDICES**

Appendix I:	Checklist questions during data collection.....	56
Appendix II:	Checklist questions for user acceptance validation.....	58
Appendix III:	Checklist questions for system testing results.....	59
Appendix IV:	Code for a login page.....	59
Appendix V:	Code for indicator performance .....	61
Appendix VI:	Code for upload activity attachment .....	63

## **LIST OF ABBREVIATION AND SYMBOLS**

AIDS/HIV	Acquired Immune Deficiency Syndrome/Human Immunodeficiency Virus
AMREF	Africa Medical and Research Foundation
API	Application Program Interface
DBMS	Data Base Management System
DHIS	District Health Information System
DFD	Data Flow Diagram
GUI	Graphical User Interface
HTML	HyperText Makeup Language
HMIS	Health Management Information System
HSSP	Health Sector Strategic Plan
ICT	Information Communication and Technology
IDE	Integrated Development Environment
M&E	Monitoring and Evaluation
MESI	Monitoring and Evaluation Strengthening Initiatives
MoH	Ministry of Health
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MoHSW	Ministry of Health and Social Welfare
MTR	Mid Term Review
NMCP	National Malaria Control Program
NTLP	National Tuberculosis and Leprosy programme
PHP	Hypertext Pre-Processor
PMBOK	Project Management Body of Knowledge
PMES	Project Monitoring and Evaluation System
PPMS	Project Performance Monitoring System
RDBMS	Relational Database Management System
SDLC	System Development Life Cycle
TB	Tuberculosis
UNDP	United National Development Program
UNESCO	United National Education, Scientific and Cultural Organization

WASH  
WHO

Water Sanitation Hygiene  
World Health Organization



# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Problem

Monitoring and Evaluation (M&E) systems are used globally and they show positive results, improve the performance and achieving results in programs/projects activities. Monitoring and evaluation is essential in helping managers, donors, policymakers, planners and implementers to understand and obtain the information they need to make informed assessments about project process/operations (United National Development Program [UNDP], 2002).

Program is the collection of related projects and activities intended to meet the public needs. The project is a process of controlled activities and coordinated with the start and finish dates undertaken to achieve objectives. Monitoring is an ongoing activity which involves data collection and analysis to track the progress of the project implemented against objectives and selected indicator. Evaluation is a process of assessing, measuring, observing the ongoing or completed projects (Crop & Foundation, 2017). Monitoring and evaluation is a system used by organizations/governments to assess and manage the performance of a project against the plan and desired result (Tengan *et al.*, 2019). Performance on project activities information is based on schedule, cost, scope, quality and resources (Project Management Body of Knowledge [PMBOK], 2001).

In today's world, M&E provides the performance of programs, projects, and government policies, it classifies the things to do and not to do and it gives the reasons why (Attah *et al.*, 2015). Studies reveal that organizations can improve their performance, effectiveness and achieve good results by employing M&E systems to their program/projects (Landicho, 2018). According to Sanga *et al.* (2013), a web-based M&E system is a tool characterized by a number of users who visit a web page to update, view information and to check the status of projects.

The Tanzanian government has shown much effort recently in improving the lives of its citizens by initiating and implementing different programs/projects in various sectors such as community empowerment and health ((Ministry of Health and Social Welfare [MoHSW], 2012). The Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDEG) in

Tanzania, is committed to providing basic health care services that are good, equitable, quality, affordable, accessible, gender-sensitive and sustainable. Despite having programs/projects initiated at MoHCDGEC, there is a lack of M&E systems for tracking the implementation of an increased number of projects to improve data quality, performance, reduce paperwork and achieve good results in project plans.

## **1.2 Statement of the Problem**

The M&E is the main part of a project or program that is undertaken in the health sector to allow management to assess whether the objectives are met and if they are not met; they can redirect the resources to better achievement. Having an M&E framework for the program/project enables the MoHCDGEC to assess and track the results of the implementation plan. The strengthening of electronic M&E in programs helps to improve the quality of health care and health services delivery as the results the government will assure all stakeholders who operate will go as expected and the results will be in line with the decisions which are made.

According to the Swai *et al.* (2014) it analysis the eHealth strategy development in Tanzania that, the health care can be delivered to the citizen by supporting health care operation, information access, decision making and management. Through that, the ministry of health and social welfare has recognized the potential of Information Communication and Technology (ICT) by transform health care delivery and help to achieve the health sector goals and involvement of stakeholders in all stages of implementation. However, Tanzania's health sector has different programs which they implement but there are lack/barriers of effective sharing of information among the participants of those programs.

The existing system used to collecting and reporting data at the MoHCDGEC is in paper-based and electronic database system such as Health Management Information System/District Health Information System (HMIS/DHIS), however, these systems are not capable to monitor and evaluate those projects as a result of lack of timely adoption of remedial action for the risks encountered. Data collection, reporting, and management are not uniform for different projects sponsored by different donors within the ministry (MoHSW, 2010). By adopting the web-based system to monitor and evaluate the project can solve and provide accurate information timely.

From 2008 to 2013, the National Malaria Control Program (NMCP) faced the challenge of coordinating the collection of M&E information (Malaria *et al.*, 2013). On other hand, the Health Sector Strategic Plan III (2009–2015) at Ministry of Health (MoH), highlighted the lack of coordination among ICT departments, ministries, agencies and partners, lack of M&E process in epidemics such as malaria, tuberculosis (TB) and HIV/AIDS due to inefficiencies and poor infrastructure of the healthcare system (MoH, 2015).

In the HSSP IV 2015-2020 for M&E system in the health sector there was the strategic direction that shown there is a need/lack of a web-based system for data collection, analysis, linking information system, data for decision making and providing stakeholder access to data. Accoding to (MoH, 2015);

There are still many parallel systems, often automated, and health workers complain about extra workload. Attempts to rationalize and streamline health information systems have not been effective so far. The culture of using data for decision-making is still very weak ( p. 15).

Despite the reported increasing demand from donor-funded health programs on the use of electronic M&E systems to improve data quality, data access, reduce workload, accurate report and data analysis such systems are not available at the ministry of health (United & Welfare, 2018). Therefore, this study intends to develop a web-based M&E system with appropriate indicators to be used to track and report the status of projects and allow prompt actions to mitigate the risks and challenges encountered. Moreover, the developed system will help to simplify work and generate quality data for effective planning and successful project implementation. It will provide collaboration, network, capacity building to stakeholder and donor (Nyaboke, 2017).

### **1.3 Rationale of the Study**

This study will minimize the challenges by simplify the work and improve the progress of project implementation at the ministry of health. The proposed system will allow data sharing

within the stakeholders, decision and policymakers who review and track the progress of a given projects. In addition, it will give the status of projects information as a feedback mechanism.

## **1.4 Objectives of Study**

### **1.4.1 Main Objective**

To develop a web-based M&E system to improve, keep track of implementation progress on success and good performance government projects at the ministry of health in Tanzania.

### **1.4.2 Specific Objectives**

- (i) To analyze the current M&E system of various government projects at the ministry of health.
- (ii) To design and develop web-based M&E system for the government projects at the ministry of health.
- (iii) To validate the developed web-based M&E system for government projects at the ministry of health.

## **1.5 Research Questions**

The study was conducted by the following key research questions:

- (i) What are the requirements for developing a web-based M&E system for government projects at the ministry of health in Tanzania?
- (ii) How will the web-based M&E system for government projects at the ministry of health in Tanzania be developed?
- (iii) What are suitable approaches to validate a developed web-based M&E system for government projects at the ministry of health in Tanzania?

## **1.6 Significance of the Study**

To have sustainable health projects in Tanzania so as to achieve the targeted goals, to add more awareness and knowledge on planned health projects which are to be started or initiated in the

ministry of health and to improve the performance of program plans and implementation. The system will help to cover challenges that contribute to the slowness of projects in the ministry of health. Moreover, the developed system will provide efficient security to the system and data storage of different projects and help to simplify works and generate quality data effective planning and successful project implementation.

### **1.7 Delineation of the Study**

The web-based monitoring and evaluation system for government projects will be developed by using the software requirements collected at the ministry of health in Tanzania, to assist the monitoring and evaluation officials and other stakeholders in making a timely decision regarding the M&E of health projects in the ministry. However, other ministries overseeing non-health projects might need to extend the results of this research to be applicable in their projects.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Project Monitoring and Evaluation**

Project is an activity or task to be executed over a fixed time to give the desired outcome or to achieve the specific objectives (PMBOK, 2001). Monitoring is the systematic collection and analysis data or information that is needed for evaluation against the plan and takes place at the beginning and gives ongoing information via selected indicators to know the progress of the project (Guddanti *et al.*, 2017). Project monitoring gives feedback about the project progress to the beneficiaries involved in the project, all implementers and the donor who fund the project.

Evaluation is the collection and analysis of information about project activities, and it aims to make judgments about the activities of the project and to inform program decisions. The purpose of the evaluation is to determine the effectiveness, efficiency, sustainability, impact of projects and whether projects have met their targets. It helps to identify areas to improve, and by sharing the project output to others, it creates knowledge in project management and promotes accountability to donors, stakeholders and citizens (Rodrigues-Garcia *et al.*, 2007). Moreover, in evaluation, the project manager can check how the project has performed in terms of time, cost, resources, quality and schedule.

#### **2.2 Importance of Monitoring and Evaluation**

Monitoring and evaluation is useful for measuring and checking the status or progress of project activities. It assists the program management in decision making, builds accountability and ensures that the funds provided for the project are used in accordance with the planned activities. Monitoring and evaluation provides the information which can be used in future plan, advocacy and gives an indicator on a project whether is in good progress or not and can solve the problem occur. Nyakundi (2015) highlighted that M&E should be done at all stages to inform the beneficiaries, donors, partners about project efficiency and effectiveness.

### **2.3 Monitoring and Evaluation System**

Monitoring and evaluation systems are used to help the government or organization to assess and manage the performance by checking if the project or project has met the needs of the end-users or beneficiaries and has been implemented according to the plan (Miako 2018). Monitoring and evaluation system further provides the data necessary to design, guide strategic planning, implement the projects and also allocate or re-allocate the resource in a better way.

### **2.4 Tools and Techniques for Effective Monitoring and Evaluation**

Tool and techniques which are used in projects help to support managers in controlling and planning the overall project activities. The selection of good techniques and tools improve the performance of projects to meet the expectations planned and it depends on the data, materials which are needed, cost and stakeholder who are involved (The World Bank, 2004).

### **2.5 The Strength of the Monitoring Team and Project Success**

Monitoring and evaluation is part of a program or project that is undertaken in the government/organization which allows the management to evaluate objectives if they are being met or not. The success of projects is influenced by the monitoring team because they work together to deliver the desired output of planned activities of projects. The effective monitoring team creates the project to be a success due to common goals and objectives, open communication, effective decision making, balanced participation, cooperative relationship and strong leadership. The project monitoring team keeps the judgment of ongoing project activities, monitors the progress of projects and solves the challenges in case there is a gap in planned goals (Radujković & Sjekavica, 2017).

### **2.6 Related Study on Monitoring and Evaluation System**

Globally, M&E assists governments and organizations to extract data from past and ongoing activities, it provides performance on projects' progress and measures whether the project is meeting its objectives or progressing in the right direction. Without having M&E, it is impossible to evaluate if the project was going in the right direction or not and what future efforts might be required (UNDP, 2002).

Traditionally, M&E focused on assessing input with the implementation processes. Today, M&E focuses on assessing the factors that contribute to the development output, outcome, partnerships, advocacy, coordination and policy advice. The project managers are required to apply the information gained from M&E to improve the project activities and strategies. The better decisions in projects lead to greater accountability to the stakeholder and help to improve performance in project activities. Close partnership with stakeholders creates knowledge sharing, skills, learning, capacity, project decision planning, provides valuable feedback and makes a positive contribution to the effectiveness of development (UNDP, 2002). Recent studies show that there has been an increase in awareness creation on M&E in public and private and organizations, together with an increase of institutions that offer M&E courses (Mkama, 2017). However, M&E systems in most organizations are manually operated.

A study by Micah and Luketero (2017) on non-government maternal health projects in Kenya, recommends increasing the number of M&E staff training, investing in ICT, involving stakeholders in M&E process to provide better feedback on achieving quality data and using the M&E plans. The study of Wachaiyu (2016) was conducted in Kenya to determine the M&E factors that influence the success of development projects. The factors determined include a selection of good tools and techniques, monitoring team, M&E plan and availability of funds. Having all this enables the M&E activities for a project to be performed well and having a good result.

A report by United National Education, Scientific and Cultural Organization (UNESCO) shows that most governments have data systems, sophisticated or simple for measuring the results of any program on the target population/group, the cost-effectiveness of their spending and the outputs of the program (Education *et al.*, 2016). The report further indicates that few governments have acquired the M&E system to monitor and evaluate performance in terms of outcomes of all their programs. It is also reported that few countries in the developed world have well designed M&E systems and as a result, they have a high performing, dynamic and sustainable projects. Landicho (2018) developed a web-based M&E system for highway and road projects to provide information concerning road projects which are easily accessed by any user or public. The consistency, evaluation, effectiveness and the visual clarity of the project were



rated as excellent. The study reaches the goal of improving road project monitoring and helps the Department of Public Works and Highways at Philippine government.

In Kenya, a study by Amos (2015) on Water, Sanitation Hygiene (WASH) program under Africa Medical and Research Foundation (AMREF), reported poor participation in activities like data collection, preparation of M&E timetables, designing, identification of indicators, decision making and feedback which are very crucial. The study, however, failed to suggest a solution to improve the participation of leaders and organizations to make a good performance in M&E activities. According to Moyne *et al.* (2018) a web-based tool was used to support the collection and reporting of data for learning, teaching and research in education. The tool was needed by students, researchers and instructors for education project design. This web-based tool can be adopted in the ministry of health of Tanzania to help simplify the implementation of project activities and allow feedback from different stakeholders.

The study of Kiboi *et al.* (2018) identified poor information and data sharing among stakeholders in the provision of healthcare services. The study insisted that it was significant for M&E practitioners to be trained and to have seminars in order to avoid the existing challenges. However, it did not suggest having an electronic M&E system for Healthcare service to simplify the data collection and easy sharing the information among stakeholders. The study of Ahmed and Magdi (2017) proposed M&E system for employees and organizational performance for the ministry of industry and trade in Egypt. The system, not only provided regular reports but also assisted the top management to get feedback from customers and employees, eventually increasing the employee performance. However, the study did not indicate an automatic planning section for a comparison between the achievements and the plans.

In a similar study Suen and Cheung (2004) a web-based was developed for construction project, the aim was to support the project manager in construction projects control and measure the performance in terms of quality, people, time, cost, client satisfaction and communication. However, the system had cost implications in ensuring reliable security, preventing downtime and facilitating constant monitoring. In the agriculture and natural resources projects (2005-2010) at Sokoine University of Agriculture in Tanzania supported by the Norwegian government Sanga and Fua (2014) a web-based M&E system was implemented in order to build the capacity of smallholder farmers and traders, satisfy their demand for knowledge, improve communication,

ease the M&E tasks and improve the dissemination of information. Despite its goal, the scope of this research was narrow and other M&E activities continued to be manually operated, hence less effective and efficient.

Literature reveals that most government/organizations do not employ computerized M&E systems and those having these systems lack a systematic early informing mechanism of the projects' progress. This study intends to develop a web-based M&E system to keep track of implementation progress and give alerts on the success or failure of individual projects with their own sub-goals that contribute to overall performance.

## **CHAPTER THREE**

### **MATERIALS AND METHODS**

#### **3.1 Research Case Study Area**

The study was conducted at the MoHCDGEC in Dodoma and Dar es Salaam regions, where different health projects such as national malaria control program, national tuberculosis and leprosy program and; Tanzania capacity and communication project are monitored and evaluated. This research was focused on collecting, identifying and analyzing different M&E practices for various projects at the ministry of health in Tanzania.

#### **3.2 Sample Size and Technique**

The study employed a technical purposeful sampling technique whereby it involved people who are working at the ministry in the areas of M&E, project management and ICT (Palinkas *et al.*, 2015). This technique was selected to collect the data from managerial staffs to obtain more information and identify important requirements that are rich and specific to this study (Horng *et al.*, 2015). The total numbers of participants were twelve, three M&E staff out of 30, four ICT staff out of 21 and five project members out of 56 at head office.

#### **3.3 Data Collection Methods**

To obtain the required information, both secondary and primary sources of data collection were used. The data was collected using document review, interview and focus group discussion as follows:

##### **3.3.1 Document Review**

The main objective of selecting this tool was to understand the background information of the existing system, how it operates to help to formulate the questions for the interview and focus group discussion (Evaluation, 2001). The documents reviewed were weekly, monthly, quarterly and annual project reports as well as reports generated by health management information system/district health information system (HMIS/DHIS). This was done to understand the main

information/data that are required in programs/projects and to identify the key performance indicators, activities and targets (National Tuberculosis and Leprosy Programme [NTLP], 2016).

### **3.3.2 Interview**

This involved project members responsible for programs of malaria, Tuberculosis and HIV/AIDS. The interview was conducted using a semi-structured interview to allow them to express their general views, opinions and experience (Bryman, 2016). The interview guide was based on how data is collected, the method/tools used for data collection and the challenges that project members face in the implementation of projects/programs (Evaluation, 2001).

### **3.3.3 Focus Group Discussion**

The focus group discussion was conducted with the ICT department and M&E staff. The aim was to analyze the current M&E system performance, tools used to monitor and evaluate projects and the current system used to collect and manage data about the routine information of the projects, and data about indicators used to measure the achievements of objectives in different activities in projects. Another discussion was based on the challenges the M&E staffs face in practice and the implementation of the M&E system in different projects.

### **3.4 Data Analysis Method**

Qualitative analysis methods were employed in this study to get what is required for analyzing a current M&E system for the ministry of health projects in Tanzania. The findings of the study were then reported.

### **3.5 Requirement Analysis**

Requirement analysis is used to determine the requirements for a new system and should be meet the expectation of the end-users. For implementing the proposed system, both functional and non-functional requirements were collected.

### **3.5.1 Functional Requirements**

The functional requirements describe the expected behavior of the developed system in terms of tasks/services/operation to be performed by the system and the use case diagram to describe actors' activities and actions. Users have different privileges to access the system's features. Functional requirements for the proposed system are classified according to various design aspects such as visual elements of the web site, navigational structure and user interface. Table 1 present the functional requirements for the proposed system.

**Table 1: Functional requirements for the proposed system**

<b>Users of the System (Actors)</b>	<b>Description</b>
System admin	Register users, manage and update the system.
Project manager	Register project details, assign members to the project and generate reports.
Monitoring and evaluation officers	Add and update indicators for projects activities and targets either by quarterly bases or year. Should allow the progress tracking of project by measuring the performance and generate the reports.
Accountant officers	Add/update budget for project activities and verify if the accountants function was correctly captured.
Program members/project teams	Entering data with attachments either by weekly, monthly or quarterly bases in the system.
Account, project manager, donor, partners and national level	Provide feedback from the generated reports.
Users	To view the status of projects and report of the projects.

### **3.5.2 Nonfunctional Requirements**

The nonfunctional requirements are not concerned with the function of the system or what the program should do, but with how the system should work and the quality attributes of the system that users care about. Table 2 present the nonfunctional requirements for the proposed system.

**Table 2: Nonfunctional requirement for the proposed system**

Quality Factor	Description
Performance	The system will support many terminals simultaneously and handle multiple users without failure.
Usability	All users will be satisfied with the usability of the proposed system and be able to complete different tasks.
Reliability	A proposed system will maintain its performance and be assured by making recoverable, website robust and available under adversity.
Security	The system will manage the services and data in such that protection information from external attacks using authentication, authorization and encryption.
Interoperability	The system will be interoperable with the existing system at the ministry.
Maintainability	The maintenance and modification of the system will not cause the website to shut down more than once in 24 hours.
Recovery	The system will be able to recover after some damages.
Flexibility	The system will have the ability to add the new notification/status of projects before and after the deadline.

### **3.6 Conceptual Design**

After determining and analyzing the requirements of the proposed system, a conceptual design for a proposed system for government projects at the ministry of health was developed.

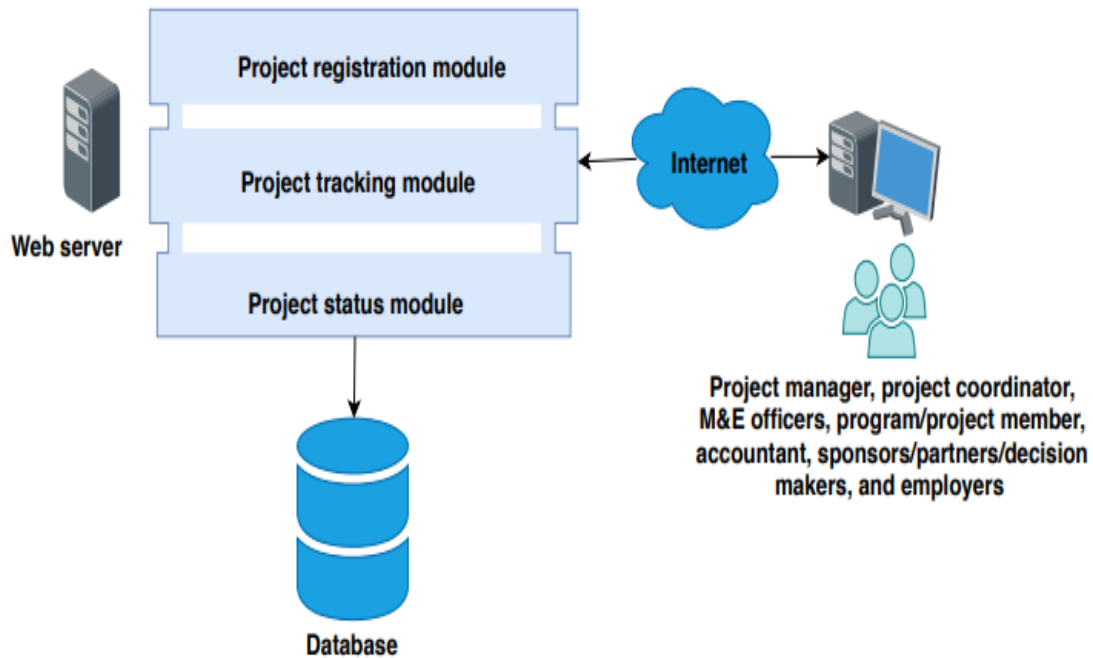
The proposed web-based M&E system will contain three modules; the project registration module, projects tracking module and the project status module. The project registration module allows the system administrator to add and manage all users/members (project members or project teams, project coordinator, M&E staff, accountant and donor fund/partners/other stakeholders of the project and other employees). The project manager will register project information such as; project title, location, the time frame of the projects, financial document/budget of the project and; browse/upload available information related to their projects and project activities, and assign members to those projects.

In the project's tracking module, the M&E staff will be able to add/update indicators of the project. The accountant will add/update the activities budget for every project in the system. The project members will enter basic data/information (multimedia data), pictures that are taken at different sites will be submitted to the system. Then, M&E staff will review this data/information to check the indicators and targets for each activity to track the performance/progress of different projects and automatically the percentage or graph will be created. Also, the system will offer additional functions such as providing an interface and workflow for project teams to submit their reports electronically.

The project status module will be designed in such a way that it gives alerts on failure or success of different projects and will display a warning on the system dashboard before the deadline of the projects. Figure 1 presents the designed solution for a proposed system for government projects at the ministry of health in Tanzania.

The proposed system will use the existing hardware which is used for DHIS/HMIS, but it may require/need some additional hardware for the project activities. The system will be user-friendly in such that it needs less effort for novice users to be familiar with it and does not require professional skills to understand how to use. The system updates will not a big issue since the system is a web-based tool; the system admin will need to update the online server so that all users can access the latest version.

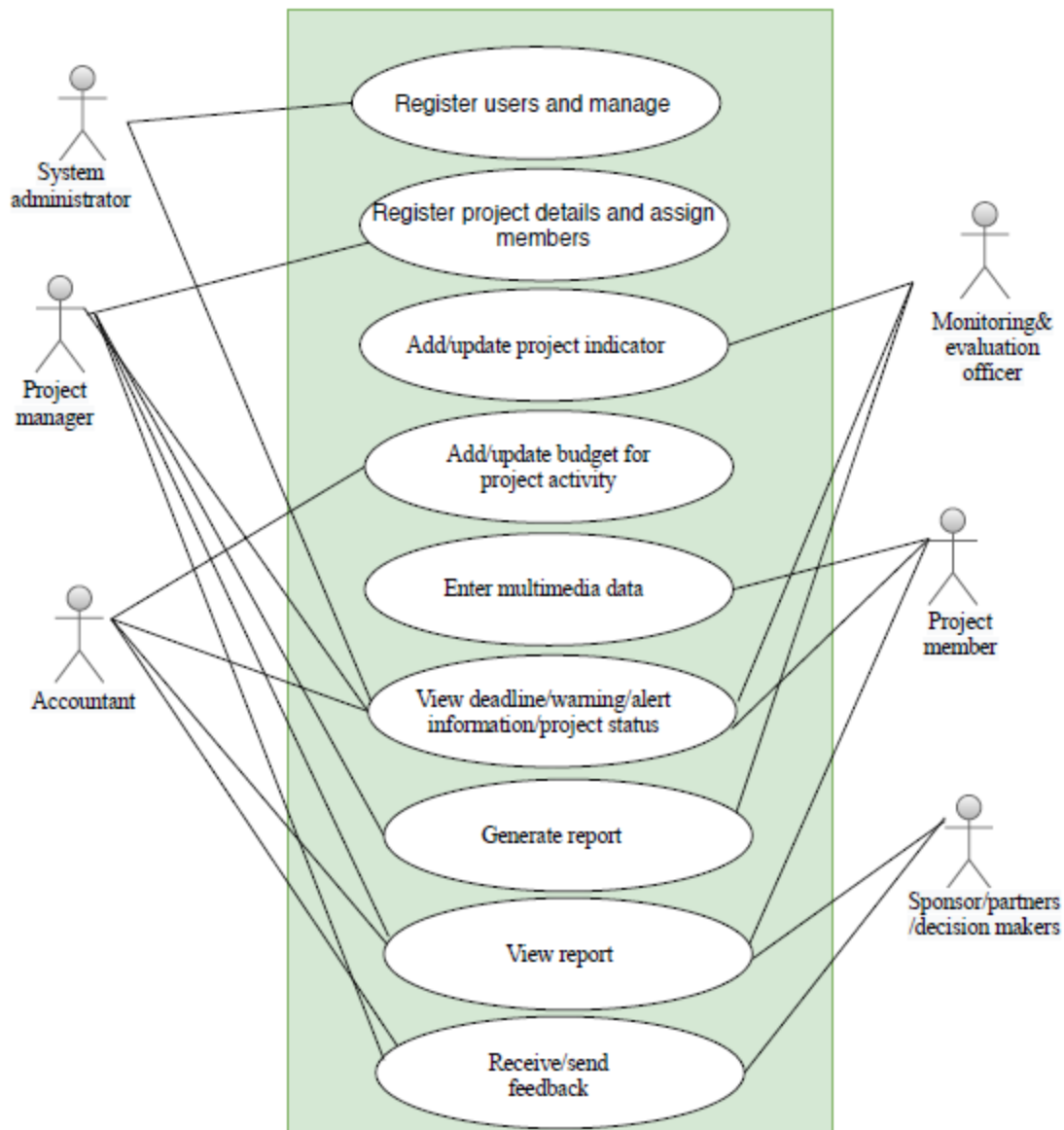




**Figure 1: The designed solution for proposed system**

### **3.7 Use Case Diagram**

The use case diagram is used to show all actors/users of the system and how they interact with the system and the relationships between them. It used to describe the processes or actions of a user can perform in the system (Arwa, 2016). The use case diagram for this study shows how users will interact based on the roles they perform in the proposed system. The actors are project managers, system administrators, M&E officers, program/project members, accountants, sponsors/supporters/partners and other employees who will be able to use the system. Figure 2 presents the use case diagram of the proposed system.

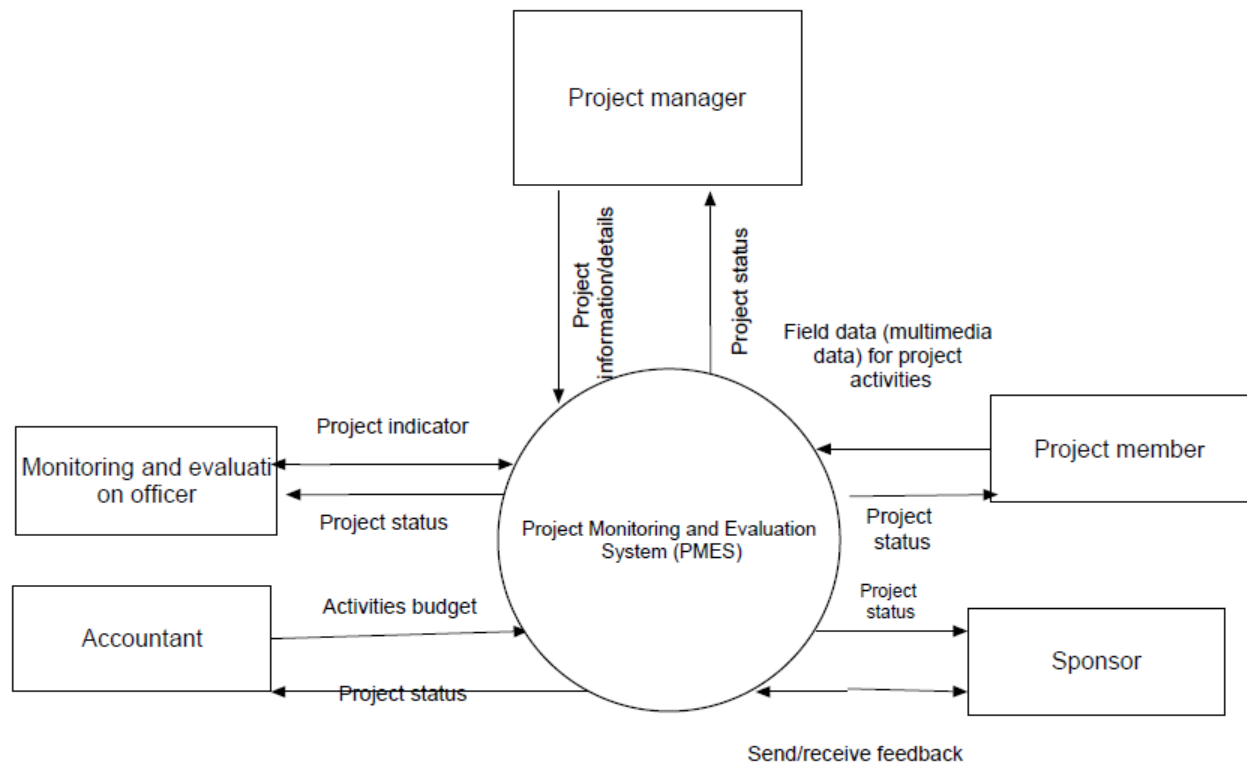


**Figure 2: Use case diagram**

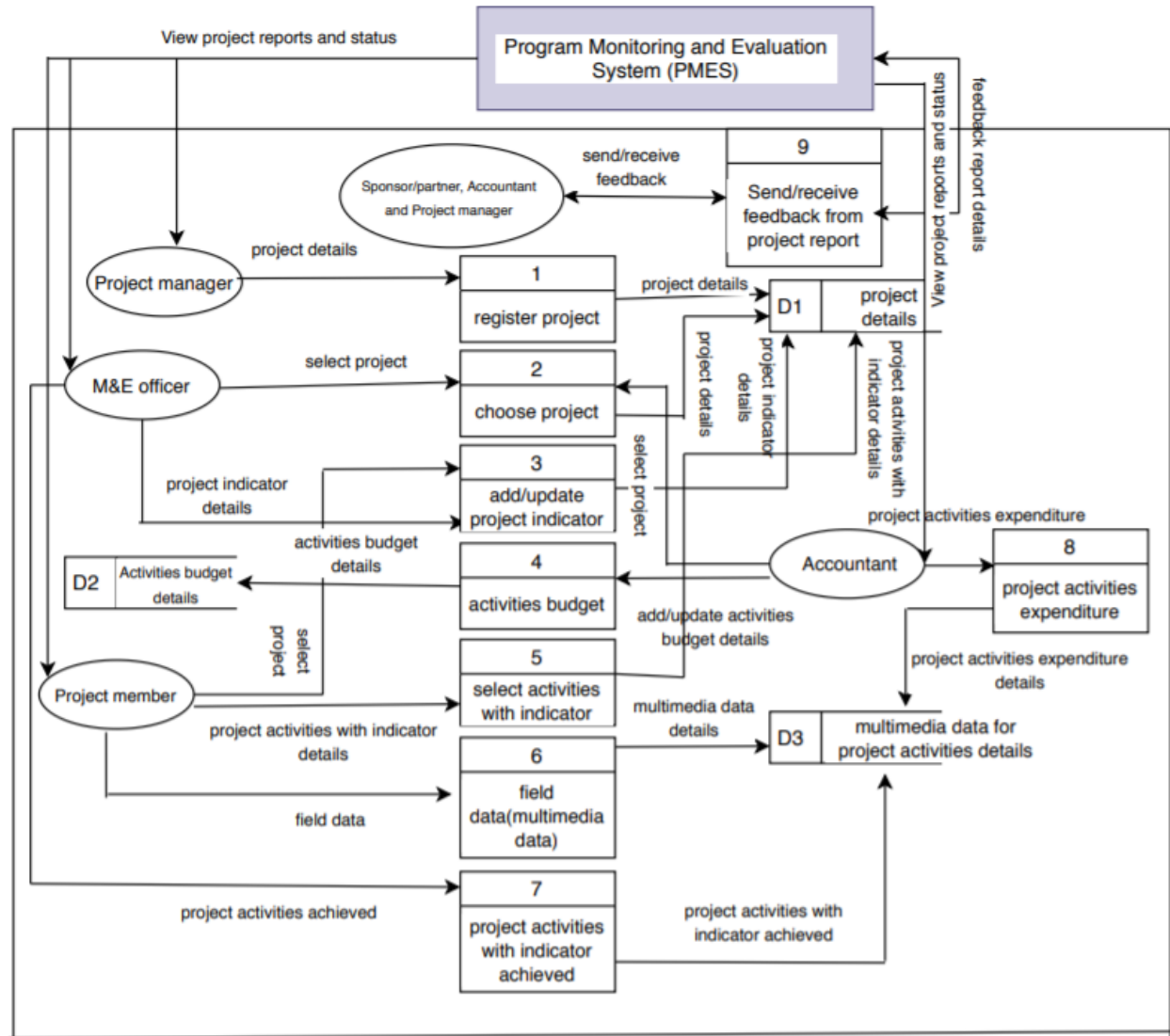
### 3.8 Data Flow Diagram

The study of Ibrahim and Yen (2010) has discussed how to model a business process flow by using DFDs and present a set of semantic rules and syntax of the data flow diagram. The system development life cycle (SDLC) has four processes during the development of the system which are planning, analysis, design and implementation, in the analysis phase, data flow diagrams (DFD) and context diagram are used to produce the process model of a system. The process model is important in the requirements in a graphical view. The dataflow diagram is used to

show how data will flow between actors (Svobodová & Černá, 2018). In this study, the context diagram (Fig. 3) is known as level 0; it shows the overview of the whole proposed system and it comprises the interaction between the developed system and its external entities. This approach helps developers, system analysts and stakeholders to understand the system. The data flow diagram (level 1) presents the flow of information for all processes involved in each stage and the data stored when the process is completed. Data flow diagram consists of four symbols which are external entities, data flows, processes and data stores. The DFD help stakeholders to understand the flow of information and processes of the system (Valacich *et al.*, 2012). Figure 4 presents the data flow diagram for the proposed system.



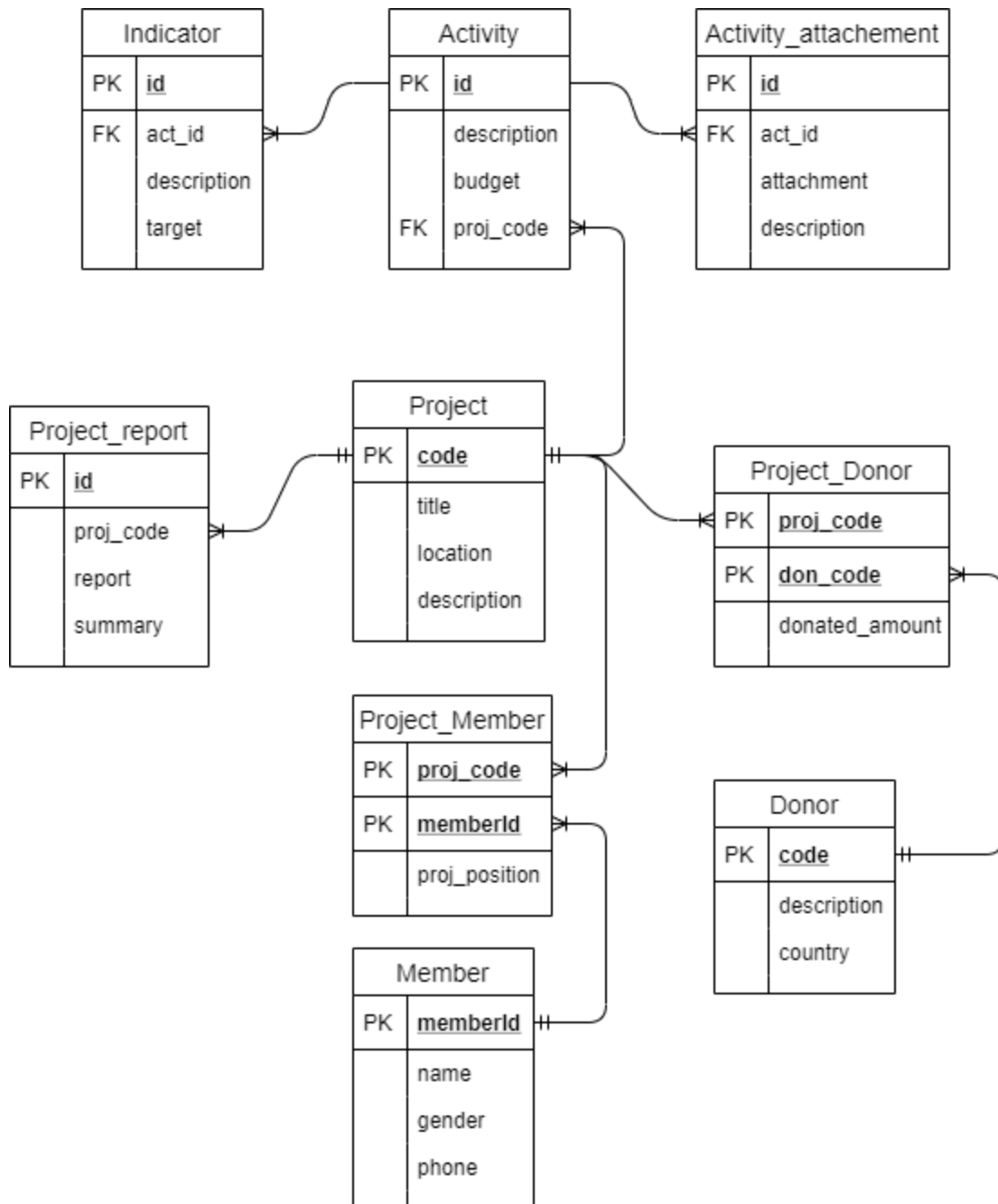
**Figure 3: Context diagram**



**Figure 4: Data flow diagram**

### 3.9 Database Schema

The database schema is the logical presentation of the database created by the database management system (Solihin *et al.*, 2017). It provides a structure of the database architecture and graphical view. It defines how data are organized and the relations among them are associated. The logical diagram in database schema comprises entities, tables, attributes and relationships between the entities. The database schema of the proposed solution is presented in Fig. 5.

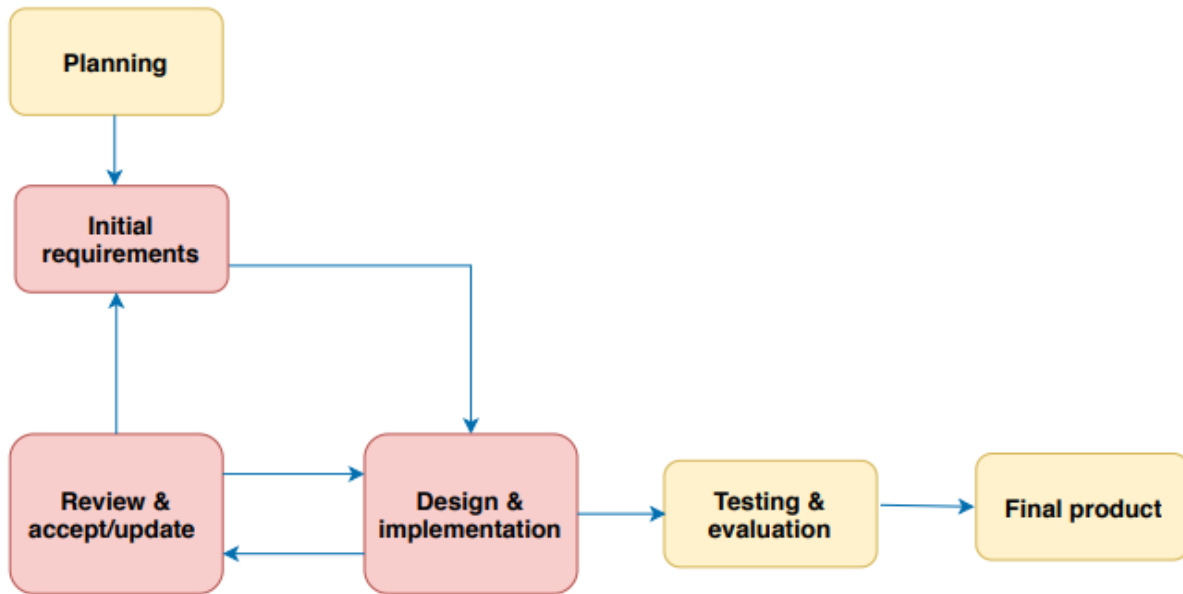


**Figure 5: Database schema**

### 3.10 Module Development Approach

To develop the proposed system, the evolutionary prototyping approach was used because it allowed the changes in every phase. Based on the user's requirements, the selected approach helped the developers to focus on a part of the system that they understand instead of working on

a whole system (Chen & Huang, 2002). Evolutionary prototyping is useful when the users of the system do not clearly understand the requirements since it allows updates and feedback from the users. In evolutionary methodology, the partial system is sent to the users to work on it and if they detect they request the new requirements and update the design as well as the system. It improves the prototype system, reduces the risk of the software and minimizes the work, critical and serious defects during the system testing. Figure 6 presents the evolutionary methodology used in developing the proposed system.



**Figure 6: Evolutionary prototyping methodology**

### **3.11 Tools and Technologies Used in System Implementation**

During the implementation of the proposed system, different development tools, technology and programming language were employed. The following are the tools, technologies and software used in system implementation in this study:

#### **(i) Hypertext Pre-Processor**

Hypertext pre-processor (PHP) is the server-side scripting language used for database connection and manipulation. It carries the website duties such as authenticating the user, accepting passwords and managing forum posts. Further, it can be embedded into HyperText Makeup

Language (HTML) code (Welling & Thomson, 2009). In this study, PHP was used to accept the data from the client and send them to the Data Base Management System (DBMS) for storage. It ensured the security of the user who login by maintaining the user session across the pages. Further, it was used to connect the developed system to the MySQL database.

## **(ii) MySQL**

Mystructured query language is a back-end Relational Database Management System (RDBMS) that handles database commands or instructions. It handles large databases efficiently by employing different programs to support the administration (Welling & Thomson, 2017). Mystructured query language can be installed in the various operating system and can work smoothly PHP. The MySQL was selected to capture and store store users' data and not Postgry because can run in different operating systems and it is a scalable, reliable, powerful solution, full data integrity as well as robust. It is very effective for large transaction and debugging. Also, MySQL supports logging application, data warehousing, high performance and is most commonly used for a web-based application (Darie & Balanescu, 2008). During this study, the MySQL database was used to help M&E and other project members to store, retrieve and manage data. Furthermore, different access privileges and password encryption were used to enhance security through host-based verification.

## **(iii) JavaScript**

JavaScript is the scripting language that allows the client-side data validation before data is submitted to a database. The client-side validation is important as it saves time, reduces the workload of the server, hence allows the server to concentrate on low-level verification and data processing (Suehring, 2013). In this study, apart from validation, the JavaScript libraries such as JQuery and Chart.js were employed to improve data presentation in plotting graphs, handling tabular data and the date text field.

## **(iv) Hypertext Markup Language**

In the development of this system, HTML was used to displaying the web pages and other information/multimedia which are displayed on web browse (Francisco, 2013). Hypertext markup language is a markup language and not a programming language; it used to define the structure of

your content because without the HTML the browser cannot know how to display the images or texts and other elements.

#### **(v) Apache Webserver**

The Apache web-server is free and open-source that is used to process web pages on the server. It is highly customized to meet the need of different environments by using modules and extensions. Apache is a cross-platform software that works on both Windows servers and UNIX, it is reliable, secure and fast (Bowen & McGregor, 2005).

#### **(vi) Integrated Development Environment (IDE)**

The IDE used in this study was Apache NetBeans, which is free and open-source containing features that can simplify the development process such as source code highlight. Not only NetBeans can be used to write and interpret the PHP scripts but also it can test and debug the code (Wielenga, 2015). The debugging feature made us select this IDE as it helped us to easily identify errors and correct them.

### **3.12 System Testing and Validation**

In this study, testing and validation were done to ensure that the system performed its intended function and that it was rightly built as per user's requirements and meets the organizational goals when deployed on the appropriate environment. Furthermore, validation was conducted on the developed system to check there was no error coding and to make sure all requirements met the customers' needs (Jacobson & Johansson, 2004). During the implementation of the PMES, several testing procedures were applied to check the performance and validity of the system as in the following sections.

#### **3.12.1 Unit Testing**

Unit testing focuses on testing each module independently. The software developer makes sure that the code meets its requirements by segregating each module and testing if it works correctly. Since the bugs are found early, it reduces the cost of bug fixes, for instance, if the bugs are found during the acceptance testing or system testing then the cost of debugging would be high, so unit testing helps to simplify the debugging process and error handling (Markus,



2013). In this study, unit testing was employed to check if each module performed correctly before being integrated into the overall system. The PMES modules which were tested include; project registration, project tracking and project status modules.

### **3.12.2 Integration Testing**

Integration testing is done after the unit test, by combining the modules that have been unit tested. It focuses on checking the data communication among those modules, to validate whether the intended functionalities of each modules are still working after the combination (Brucker & Julliand, 2014). In this study, the integration testing was done to check if all modules of PMES are working and properly interacting with each other. The project registration, project tracking and project status modules were combined and checked if they interacted, communicated and performed different functionalities accordingly. For example, the project tracking module was tested if would still track newly added projects by the project registration module after integrating the two modules

### **3.12.3 System Testing**

The system test was employed to test the complete system by checking if the various integrated modules performed tasks as required, and to verify if the functional and nonfunctional requirements were met. During the implementation of the system, each module was tested separately to uncover errors.

### **3.12.4 User Acceptance Testing**

User acceptance testing is the process of testing the users of the actual system developed to check if the requirements satisfied their needs (Ota duy & Diaz, 2017). In this study, User acceptance testing was conducted to validate the PMES if it met the project's requirements at MoHCDGEC and to assess the application usability (Davis *et al.*, 1989). The users from various departments were trained according to their roles on how to use the system. Afterward, they were given questionnaires to evaluate if the PMES meet the intended requirements. The questionnaires contained questions that correspond to the collected requirements. Questionnaires were given to twelve respondents including four M&E staff, two ICT staff, four project members, one project manager and one Accountant to gather feedback on the usability of the system.

## **CHAPTER FOUR**

### **RESULT AND DISCUSSION**

#### **4.1 Results From Data Collection**

##### **4.1.1 The Result From the Focus Group Discussion**

###### **(i) Overview of the Existing System at the Ministry of Health**

The Tanzanian ministry of health contains four levels of health data based on data collection level; the data include those from health facilities, district, regional and national. Data recording and reporting systems in the ministry include paper-based (patient cards, registers, logbooks, summary forms) and an electronic database system (hospital record books, tally sheet, data collection books and monthly reports from HMIS and DHIS).

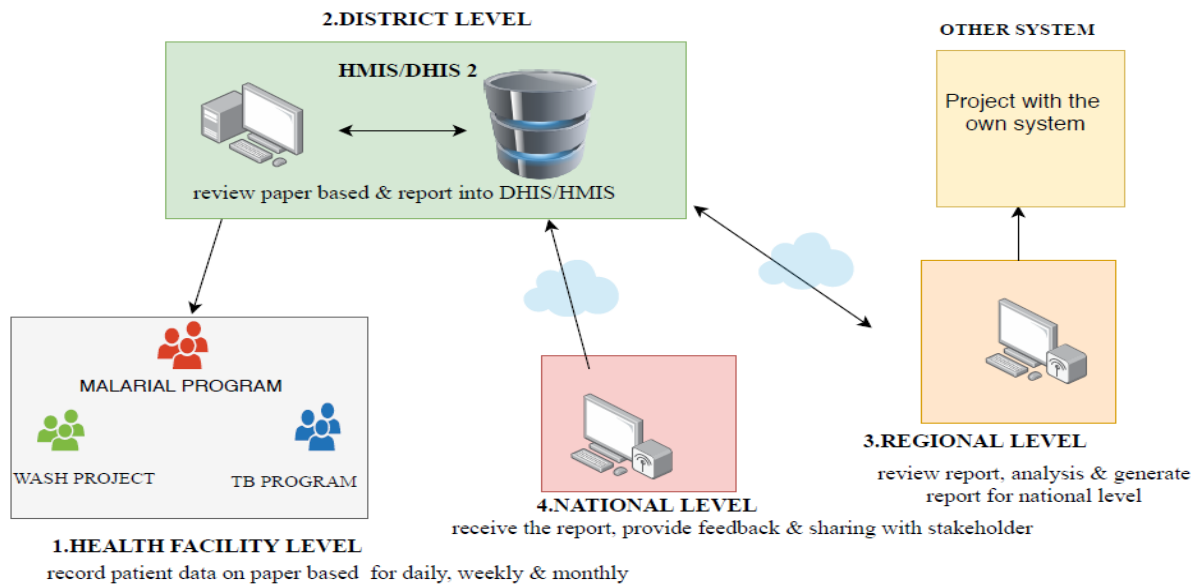
In the health facility level (health care workers), data are collected in the paper-based format/system. For example, in TB/malarial programs, data are found from the patient card, Tuberculosis (TB) register and a daily, weekly and monthly paper report is formed. Individual-level patients data are also collected using tally sheets and reported through monthly summary forms, heads of departments in each facility submits monthly summary forms report to the district (Malaria *et al.*, 2013).

The district levels receive; review the papers-based report from the health facility levels and recording them into DHIS 2/HMIS. The regional level is a part where M&E staff review the data entered at the district level and from other own projects system due to door preference, by checking the target, indicator and objectives activities if it succeeds/achieved, verify, analyzes and generate a report manually for regional use. Lastly, the National level is where the central, partner or stakeholder receive the reports, provide the feedback and disseminate them. Figure 7 presents the existing system at the MOHCDGEC on how M&E activities are carried out on government projects.

###### **(ii) Challenges for Current Monitoring and Evaluation System**

Currently, the ministry of health monitors and evaluates its projects manually; the study found that M&E staff spent a lot of time in manual work and the current system lack necessary details

about projects. All participants who were involved in this study from M&E and ICT office responded that “*there are difficulties in accomplishing the projects on time, poor information sharing among stakeholders and lack of early alert information about the status of the project*”. They also added that, “*difficult to have early alert information when implementation risks and challenges are encountered*”. Having a good M&E framework enables the ministry to track and assess the result of health projects.



**Figure 7: Present the current system on how they monitor and evaluate the government project at the ministry of health in Tanzania**

#### 4.1.2 Result from Interview

##### (i) Available Tools

The members of malaria and acquired immune deficiency syndrome programs responded that “*the current system used to collect and report routine health data at the ministry of health is an electronic database such as DHIS/HMIS*”. District health information system is adapted or customized to support HMIS implementation and operates in government hospitals at all district and region levels, and supports monthly data capturing in the facility. The DHIS/HMIS contains clinical data; the clinical data are data collected during ongoing patient care or the information about the health status of health care patients received over a specific time (Kumaliija, 2017).

Two program members responded that *“DHIS/HMIS contains facility, hospital record books, tally sheet, monthly report form and data collection books and paper-based systems such as patient card, logbook, registers and monthly summary form”*.

## **(ii) Challenges for Available Tools**

The study revealed that there are some difficulties in available tools such as manual compilation of data due to the data being in separate systems and delays in the submission of data. Also, respondents claimed that *“data is lost between primary registries to monthly summaries, from monthly to quarterly summaries”* and no or little feedback on data reported from a higher level and sustainability of the system.

### **4.1.3 Results from Document Review**

From the document review, the necessary data or information needed when a project is registered in the system were identified. Moreover, it was found that some information such as financial fund details and other stakeholders who are involved in projects was not included in the system. In the ministry of health, every project has its specific indicators and targets although some of indicators can be similar for different projects.

## **4.2 The Developed Web Application for Government Projects at the Ministry of Health in Tanzania**

The system developed provided a Graphical User Interface (GUI) to allow interaction with all users. For the aims of data retrieval, to enhance efficiency, and to make ease of use for the underlying logical design of a stored program and usability. This interface contained forms in which users could fill the requested data, and the user can also navigate through other different interfaces like download and view different information from the developed system.

The developed web application for Project M&E System (PMES) for government projects allows only the registered users to access the system. Users who are not registered cannot access the system. Figure 8 presents the login page where a user is required to provide a correct username and password to interact with the system.

Ministry of Health,  
Community Development,  
Gender, Elderly and Children  
Project Monitoring and Evaluation System (PMES)

Please, login to use the system

User Name  
admin@pmes.go.tz

Password  
.....

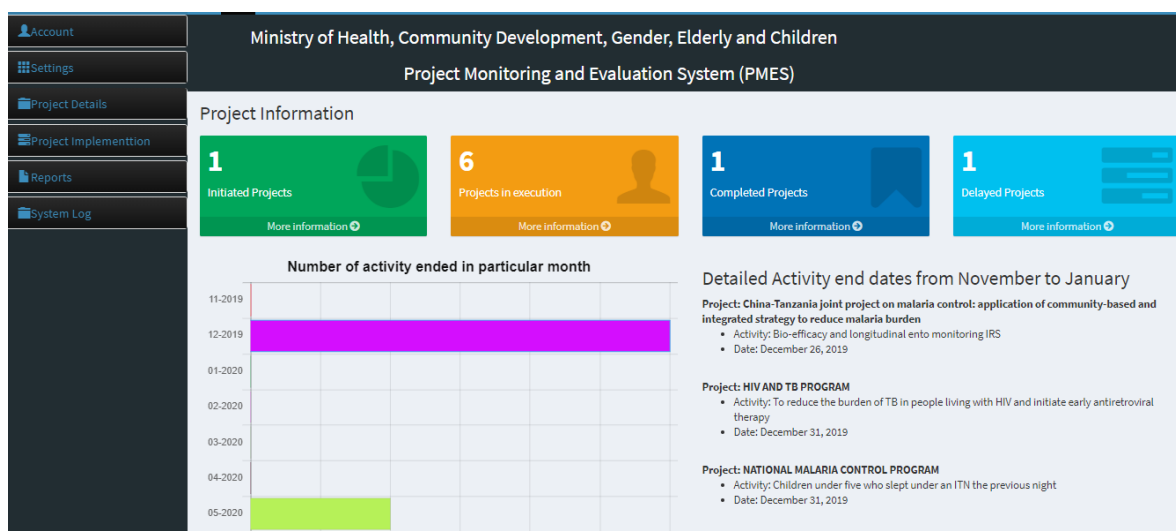
Login Cancel

[I forgot my password](#)

**Figure 8: Login interface**

The PMES is organized into six sections, namely account, settings, project, activities, reports, and system log. These sections grouped several functionalities to simplify the navigation of PMES. The home page shows the status of the project including the project initiated, implemented, completed, delayed and alerts. The dashboard page (Fig. 9) helps all system users to understand the progress of each project and hence minimize potential problems and enable them to solve the project challenges on time. This feature is vital for the MoHCDGEC as it will assist them to complete projects within the allocated time.

All registered system users can view the status of the project (dashboard/home page), but not other system menus. Registered users need the administrator's permission to access other menus based on their user roles. In the PMES, only system administrators can browse and access all system menus.



**Figure 9: Dashboard**

## 4.2.1 Account Section

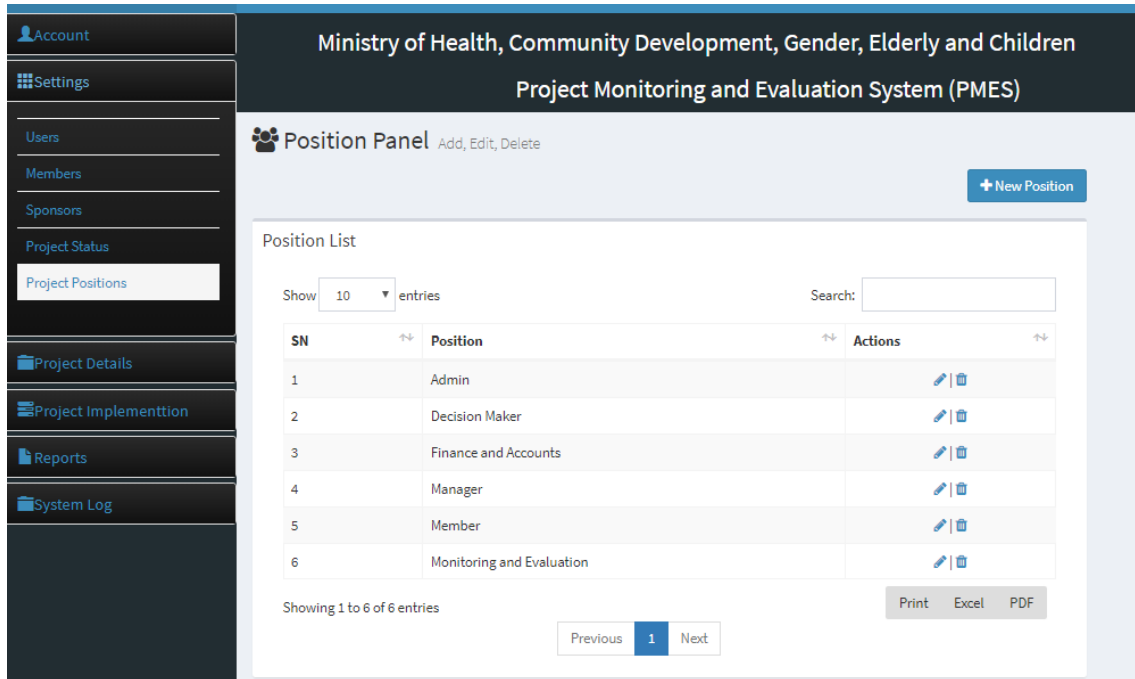
The account section allows users of the PMES to change their personal data including name, password, email address and phone number. Further, this section of PMES contains some of the security features such as enabling a user to securely log out of the system and all users have access to this part of the system.

Once users have been verified and approved, the user's role, time and date they were logged into the system appear in the account menu and users can go to account settings and edit/reset their information. Figure 10 presents the account setting of PMES.

**Figure 10: Account setting**

## 4.2.2 Settings Section

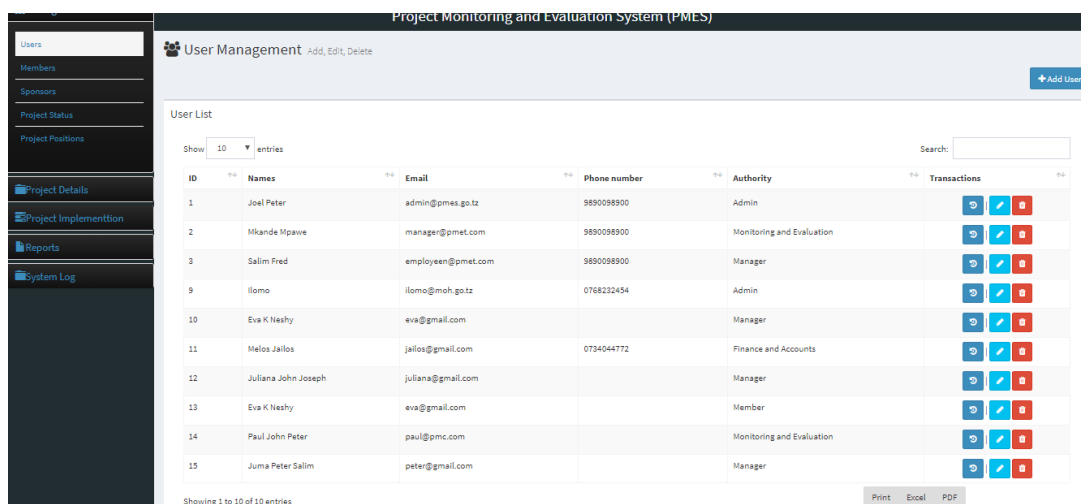
The settings menu allows the system administrator to register users, members, and project sponsors/donors. Furthermore, it allows the setting of the project's status and project position so that they can be selected from the dropdown list. In both status and position settings, a system administrator can add, update, search, delete or export the entry in various formats. In this section, the system administrator can also manage the information of the logged in user. All project members are users of the system, but not all system users are project members. When the project manager assigns a project to a member, the system automatically creates a user for the member. Figure 11 shows the position panel that displays various position settings and functionalities.



**Figure 11: Position panel and functionalities**

### (i) User Management

User management is part of the settings section that allows the system administrator to manage users. From user management, a system administrator can add, delete, edit and view the list of users, as well as search, print and export the user list as pdf or excel. Figure 12 depicts the list of users with user management functionalities while Fig. 13 shows the add user page.



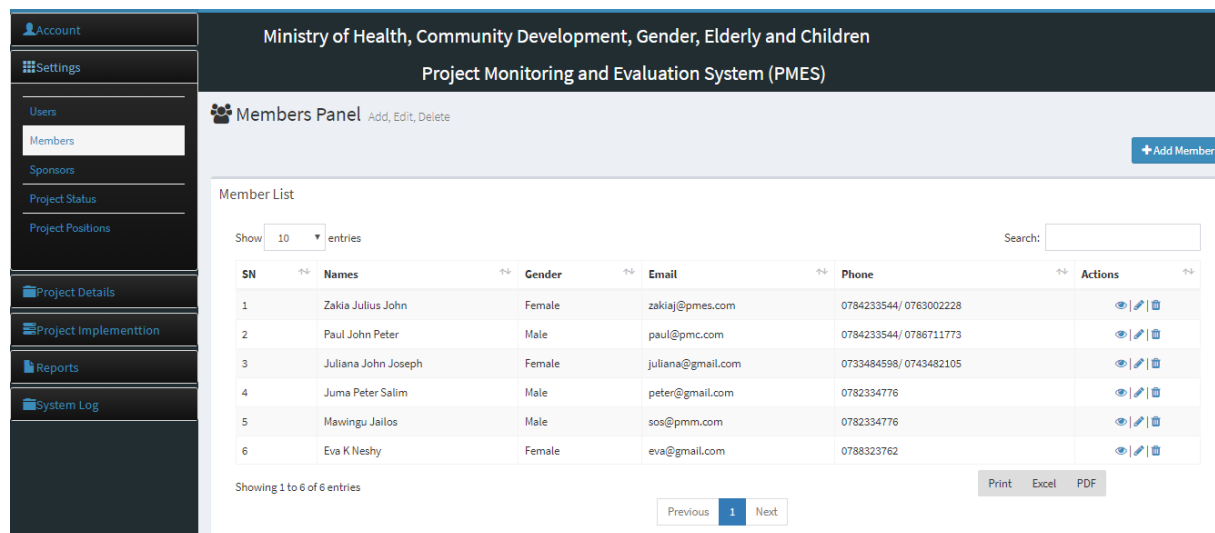
**Figure 12: List of users with user management functionalities**



**Figure 13: Add user page**

## **(ii) Members Panel**

The members' panel enables the administrator to manage the pre-members of the various projects. These are called pre-members because at this stage they are in the system but not yet assigned into the particular project. The assignment into the project is done by the project manager of a particular project. From the member panel, the administrator can add new members, search members, view member details, edit member information and delete members. It should be noted that delete member is possible only if a member is in pre-project member status. Figure 14 and Fig. 15 present the member panel and edit member page respectively.



**Figure 14: Member panel with its functionalities**

The screenshot shows the 'Edit Member Information' form in the PMES system. The left sidebar is identical to Figure 14. The main header is the same. The 'Project Members' section includes an 'Add / Edit' button. The form fields are organized as follows:

- First Name:** Zakia
- Middle Name:** Julius
- Surname:** John
- Date of Birth:** 04/10/1980
- Gender:** Female (dropdown menu)
- Office Affiliation:** Ministry Of Health And Social Welfare
- Check Number:** 33426653
- Physical Address:** 7878 Dodoma
- Email Address:** zakiaj@pmes.com
- Phone number 1:** 0784233544
- Phone number 2:** 0763002228

At the bottom of the form are 'Submit' and 'Reset' buttons.

**Figure 15: Edit member information form**

### 4.2.3 Project Detail Section

The project section has various functionalities including registration of projects, project sponsors, project members, project activities and upload project reports. Both, project manager and M&E team have access to functionalities of the project detail section.

To register a new project, the project manager enters the new project details including the title/type of project, code number, location, the start date, the end date of the project and project activities and then submits to the system. After submission, the project manager registers the project sponsor through the register sponsors menu whereby he selects the name of the project, choose the sponsor form the dropdown list, fills the amount of money sponsored by the project and then submits to the system. The project manager can further register project members through the register member menu. This is done by selecting their positions since the members were already registered by the system administrator. Then the project manager registers the project activities by entering the activities for a registered project and submitting to the system.

Both sponsors and members must be pre-entered by the system administrator. Figure 16 show the page for entering project detail, Fig. 17 present the project sponsor detail form, Fig. 18 show the project member form and Fig. 19 present project activities form.

The screenshot displays the PMES (Project Monitoring and Evaluation System) interface. On the left is a dark sidebar with a menu containing: Account, Settings, Project Details (highlighted), Register Project (sub-menu), Register Sponsors, Register Members, Register Activities, Upload Project Report, Project Implementation, Reports, and System Log. The main content area has a header for the Ministry of Health, Community Development, Gender, Elderly and Children, and the PMES title. Below this is a 'Project Management' section with an 'Add / Edit Project' link. The form is titled 'Enter Project information' and includes fields for Project Code, Project Title, Project Description (a large text area), Project Location, From Date, and To Date. At the bottom are 'Submit' and 'Reset' buttons.

Enter Project information	
<b>Project Code</b>	<b>Project Title</b>
<input type="text" value="Enter Project Code"/>	<input type="text" value="Enter Project Title"/>
<b>Project Description</b>	
<input type="text" value=""/>	
<b>Project Location</b>	
<input type="text" value="Enter Project Location"/>	
<b>From Date</b>	<b>To Date</b>
<input type="text" value="Enter Project Starting Date"/>	<input type="text" value="Enter Finish Date"/>
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

**Figure 16: Page for entering project details**

The screenshot shows the PMES web application interface. On the left is a dark sidebar with a menu containing: Account, Settings, Project Details (with sub-items: Register Project, Register Sponsors, Register Members, Register Activities, Upload Project Report), Project Implementation, Reports, and System Log. The 'Register Sponsors' option is highlighted. The main content area has a blue header with 'PMES' and a home icon. Below this is a dark banner with the text 'Ministry of Health, Community Development, Gender, Elderly and Children' and 'Project Monitoring and Evaluation System (PMES)'. The page title is 'Project Management' with a link 'Add / Edit Project Sponsor'. The form is titled 'Enter Project Sponsor information' and contains three fields: 'Project' (dropdown menu showing 'Choose Project'), 'Sponsor' (dropdown menu showing 'Choose Sponsor'), and 'Amount Sponsored' (text input field showing 'Enter Amount Sponsored'). At the bottom of the form are 'Submit' and 'Reset' buttons.

**Figure 17: Project sponsor details form**

The screenshot shows the PMES web application interface. On the left is a dark sidebar with a menu containing: Account, Settings, Project Details (with sub-items: Register Project, Register Sponsors, Register Members, Register Activities, Upload Project Report), Project Implementation, Reports, and System Log. The 'Register Members' option is highlighted. The main content area has a blue header with 'PMES' and a home icon. Below this is a dark banner with the text 'Ministry of Health, Community Development, Gender, Elderly and Children' and 'Project Monitoring and Evaluation System (PMES)'. The page title is 'Project Member' with a link 'Add / Edit'. The form is titled 'Enter Project Member' and contains three fields: 'Project Title' (dropdown menu showing 'HIV AND TB PROGRAM'), 'Member' (dropdown menu showing 'Zakia Julius John'), and 'Position' (dropdown menu showing 'Monitoring and Evaluation'). At the bottom of the form are 'Submit' and 'Reset' buttons.

**Figure 18: Shows the project member form**

The screenshot displays the PMES (Project Monitoring and Evaluation System) interface. On the left is a dark sidebar with a menu containing: Account, Settings, Project Details (highlighted), Register Project, Register Sponsors, Register Members, Register Activities, Upload Project Report, Project Implementation, Reports, and System Log. The main header is blue with 'PMES' and navigation icons. Below the header, a dark bar contains the text 'Ministry of Health, Community Development, Gender, Elderly and Children' and 'Project Monitoring and Evaluation System (PMES)'. The main content area is titled 'Project Management' with a sub-link 'Add / Edit Activity'. It features a form titled 'Enter Activity of A project' with the following fields: 'Project Title' (a dropdown menu showing 'HIV AND TB PROGRAM'), 'Code' (a text input with placeholder 'Enter Activity'), 'Activity Description' (a large text area), 'From Date' (a text input with placeholder 'Enter Activity Starting Date'), and 'To Date' (a text input with placeholder 'Enter Finish Date'). At the bottom of the form are 'Submit' and 'Reset' buttons.

**Figure 19: Project activities form**

Lastly, in the project details menu, the project manager and M&E officer can upload various project reports. The reports may include information about project activities at any time they are needed, either quarterly, annually or based on the project format agreed upon. This will make it easier for users to know the reports of various projects and allow feedback from decision making/ partnership/sponsor/among them. Figure 20 shows the project report uploading form.

The screenshot shows the PMES (Project Monitoring and Evaluation System) interface. On the left is a sidebar with navigation links: Account, Settings, Project Details, Register Project, Register Sponsors, Register Members, Register Activities, Upload Project Report (highlighted), Project Implementation, Reports, and System Log. The main content area is titled 'Ministry of Health, Community Development, Gender, Elderly and Children' and 'Project Monitoring and Evaluation System (PMES)'. Below this is the 'Project Report' section with a sub-header 'Upload Project Report'. The form contains the following elements:
 

- A heading 'Upload a Project Report'.
- A 'Project' dropdown menu currently set to 'HIV AND TB PROGRAM'.
- A 'Select File to upload' section with a 'Choose File' button and the text 'No file chosen'.
- A note: 'Upload Files that are below 100Mb'.
- A text area labeled 'Summary what your report is about' with the placeholder text 'Summarise your report'.
- 'Submit' and 'Reset' buttons at the bottom of the form.

**Figure 20: Form for project report uploading**

#### 4.2.4 Project Implementation Section

This section enriches the particular project entered in the project section. It houses PMES functionalities including entering field data, setting indicators, entering indicator achievement, setting a budget and finally entering activity expenditure.

##### (i) Indicator Setting and Achievement

An indicator is a sign or target used to measure the project progress toward achievement of the set goals or objectives. Every project has its indicators and depending on the type of project activities it can be qualitative or quantitative. The quantitative indicator is an output indicator that expresses data in numbers such as a fraction, ratio, percentage, decimal and whole number while the qualitative indicator is the performance or outcome indicator which measures data by visual, description, narrative and perception or people's judgment. These indicators allow the M&E officers to compare project performance with a target level of performance and thus help them to review, monitor and evaluate the project activities.

In the system, the M&E officer is responsible for adding or updating the indicators of project activities on a quarterly basis or depending on the nature of the projects that were planned. As

part of monitoring, the M&E officer can set the indicators for each project activity, monitor its progress and enter the achievement of a particular indicator. An activity can have more than one indicator, for instance, the activity to distribute mosquito nets can include monitoring the beneficiaries such as pregnant women and the number of villages. Figure 21 and Fig. 22 show the forms for setting an indicator and entering the indicator achievement, respectively.

**PMES** Ministry of Health, Community Development, Gender, Elderly and Children  
Project Monitoring and Evaluation System (PMES)

**Activity Management** Add new indicator

Add new indicator for an activity

**Activity Description**  
To reduce the burden of TB in people living with HIV and initiate early antiretroviral therapy

**Indicator Description**  
HIV positive TB cases registered/confirmed during the quarter

**Object Measured** **Target Value** **Target units**  
Patients registered 500 cases

Submit Reset

**Figure 21: Form for indicator setting**

**PMES** Ministry of Health, Community Development, Gender, Elderly and Children  
Project Monitoring and Evaluation System (PMES)

**Activity Management** Add/Edit Indicator Performance

Add/update Performance for each Indicator

To reduce the burden of TB in people living with HIV and initiate early antiretroviral therapy

Indicator (ID)	Measured Substance	Target	Achievement	Unit	Action
TB cases registered/confirmed during the quarter(14)	Patients registered	500	500	cases	
Determine TB patients living with HIV(15)	TB patients	500	450	TB patients living with HIV	
Provide High-quality TB treatment for HIV-infected TB patients(16)	TB patients living with HIV	500	430	TB treatments for HIV patients	

Submit Reset

**Figure 22: Form for entering indicator achievement**

## (ii) Activity Budget and Expenditure

The finance matters of the project are dealt with by project accountants. The ministry accountants control the budget and expenditures of each project. The budget subsection allows the accountant to enter and update the budget of each activity whereas the expenditure subsection allows the activity expenditures to be entered and updated. Figure 23 and Fig. 24 present the activity budget and expenditures respectively.

The screenshot shows the 'Add Budget' page in the PMES system. The left sidebar contains a menu with options: Account, Settings, Project Details, Project Implementation, Field Data, Indicator Setting, Indicator Achievement, Activity Budget (selected), and Activity Expenditure. The main header displays 'Ministry of Health, Community Development, Gender, Elderly and Children' and 'Project Monitoring and Evaluation System (PMES)'. The page title is 'Activity Management' with a sub-link 'Add Budget'. The main content area is titled 'Add/update budget for each activity' and contains a table with two rows of activity data. Each row has an 'Activity (ID)' column and a 'Budget' column with an input field. The first row is 'To reduce the burden of TB in people living with HIV and initiate early antiretroviral therapy (20)' with a budget of 36000000. The second row is 'Reduce the burden of HIV in patients with presumptive and diagnosed TB (21)' with a budget of 20249000. At the bottom are 'Submit' and 'Reset' buttons.

Activity (ID)	Budget
To reduce the burden of TB in people living with HIV and initiate early antiretroviral therapy (20)	36000000
Reduce the burden of HIV in patients with presumptive and diagnosed TB (21)	20249000

Figure 23: Activity budget setting

The screenshot shows the 'Add Expenditure' page in the PMES system. The left sidebar is identical to Figure 23, with 'Activity Budget' selected. The main header is the same. The page title is 'Activity Management' with a sub-link 'Add Expenditure'. The main content area is titled 'Add/update expenditure for each activity' and contains a table with two rows of activity data. Each row has an 'Activity (ID)' column, a 'Budget' column (displayed as a read-only field), and an 'Expenditure' column with an input field. The first row is 'To reduce the burden of TB in people living with HIV and initiate early antiretroviral therapy (20)' with a budget of 36000000 and an expenditure of 22500000. The second row is 'Reduce the burden of HIV in patients with presumptive and diagnosed TB (21)' with a budget of 20249000 and an expenditure of 15000000. At the bottom are 'Submit' and 'Reset' buttons.

Activity (ID)	Budget	Expenditure
To reduce the burden of TB in people living with HIV and initiate early antiretroviral therapy (20)	36000000	22500000
Reduce the burden of HIV in patients with presumptive and diagnosed TB (21)	20249000	15000000

Figure 24: Activity Expenditure entering



### (iii) Data Entry/Field

After setting project activities, indicators and budget, the project member can log in to the system and upload a report as an attachment containing information for any project activity. Project activity reports can be uploaded daily, weekly, monthly, quarterly or depending on the nature of the project. Attachments can be a delivery report, event images, forms/sheets used in projects for reporting such data and other documents related to the activity execution and can be stored in a .pdf, .docx or .doc format. Figure 25 displays the form for uploading activity execution attachment.

The screenshot displays the PMES web application interface. On the left is a dark sidebar with a menu containing: Account, Settings, Project Details, Project Implementation (highlighted), Field Data, Indicator Setting, Indicator Achievement, Activity Budget, Activity Expenditure, Reports, and System Log. The main content area has a header with 'Ministry of Health, Community Development, Gender, Elderly and Children' and 'Project Monitoring and Evaluation System (PMES)'. Below this is a sub-header 'Activity Management' with a link 'Upload Activity Attachment'. The main form is titled 'Upload an Attachment for project HIV AND TB PROGRAM t'. It includes an 'Activity Description' dropdown menu with the text 'To reduce the burden of TB in people living with HIV and initiate early antiretrovirin'. Below this is a 'Select File (image) to upload' section with a 'Choose File' button and the filename 'TB Registered.PNG'. A note states 'Upload Files that are below 100 KiloBytes'. The 'Describe your uploaded file' section has a text box containing 'TB cases registered/confirmed during the quarter'. At the bottom, there are 'Facility' and 'Location' dropdown menus, with 'Maweni Hospital' and 'Kigoma' selected respectively. 'Submit' and 'Reset' buttons are at the very bottom.

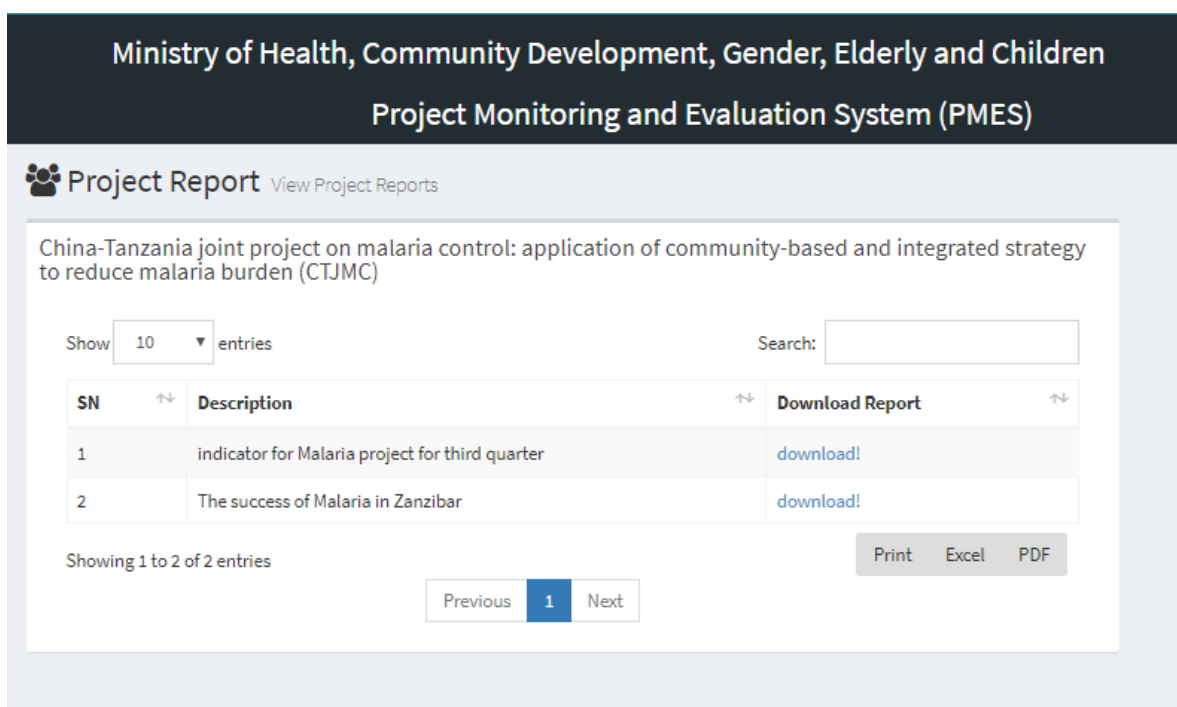
**Figure 25: Form for uploading activity execution attachment**

## 4.2.5 Project Monitoring and Evaluation System Reports Section

This section houses different reports that are needed by various stakeholders, including reports on project details, field data, indicator performance, activity expiry, financial information and project members.

## (i) Project Reports

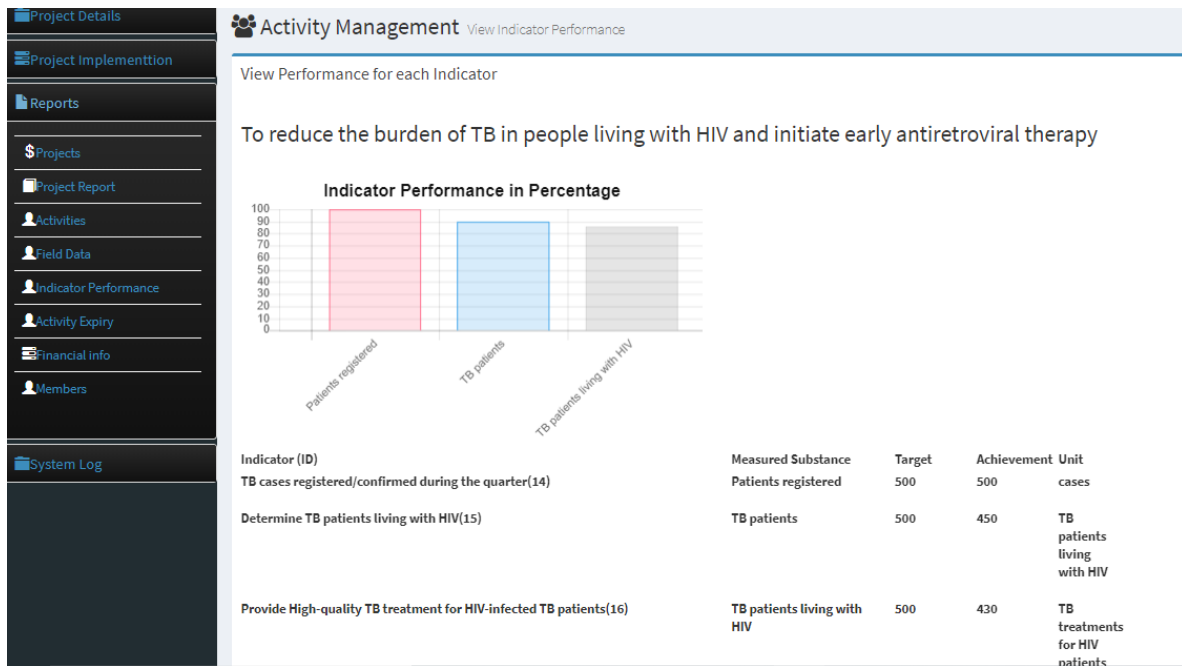
The project report section allows the intended stakeholders such as sponsors and ministry officials to download various reports relating to a particular project. Usually, these reports are either in pdf or word format, and they contain various project information combined with other information not found in the PMES. This section is useful as it stores and disseminates various M&E reports to various stakeholders. Figure 26 presents the page for downloading project report.



**Figure 26: Page for downloading project report**

## (ii) Indicator Performance

Monitoring and evaluation officials need to monitor the progress of all projects. The indicator performance section offers the M&E team the ability to evaluate the success of activities within the projects. It uses both tabular data and bar graphs to demonstrate the performance of an indicator. While the tabular data present the target and achievement of certain indicators, the graph shows the indicator performance in percentage. Figure 27 presents the indicator performance for project activity.



**Figure 27: The indicator performance for a project activity**

#### 4.2.6 System Log

The PMES maintains the system log of all user activities within the PMES. The logging is significant for tracking the system problem, security and monitoring system operation. Only system administrators can access the logging data. Within the system log section, administrators can view, create the backup and delete, and replace the log records. In order to reclaim the space occupied by the log file, the system enables the administrator to delete the backed-up log records. The log record includes the name of the user, the operation that was performed, the function used to perform an operation, the user role, IP address, browser, operating system as well as date and time. Figure 28 and Fig. 29 depicts the log history and replace log functionalities.

PMES

Account

Settings

Project Details

Project Implementation

Reports

System Log

Log Records

Replace Log

Backup Log

Ministry of Health, Community Development, Gender, Elderly and Children

Project Monitoring and Evaluation System (PMES)

Log History

Users Log History

Your log table size: 0.25 MB

Backup and Delete

Show10entries

Search:

ID	User name	Operation	Operation Function	User Role ID	User Role	User IP	Scanner	Browser All Information	Platform	Date and Time
969	Joel Peter	User Member	Manager/memberListing	1	Admin	::1	Chrome 77.0.3865.120	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/77.0.3865.120 Safari/537.36	Windows 10	2019-11-02 01:08:47
968	Joel Peter	User Listing	Admin/userListing	1	Admin	::1	Chrome 77.0.3865.120	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/77.0.3865.120 Safari/537.36	Windows 10	2019-11-02 01:07:40
967	Joel Peter	User Listing	Admin/userListing	1	Admin	::1	Chrome 77.0.3865.120	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/77.0.3865.120 Safari/537.36	Windows 10	2019-11-02 01:04:29
966	Joel Peter	Project Position	Manager/positionListing	1	Admin	::1	Chrome 77.0.3865.120	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/77.0.3865.120 Safari/537.36	Windows 10	2019-11-02 01:02:38

Figure 28: The PMES log record history

PMES	
<div>Account</div> <div>Settings</div> <div>Project Details</div> <div>Project Implementation</div> <div>Reports</div> <div>System Log</div> <div>Log Records</div> <div>Replace Log</div> <div>Backup Log</div>	<div>Ministry of Health, Community Development, Gender, Elderly and Children</div> <div>Project Monitoring and Evaluation System (PMES)</div> <div>Download Backup Log</div> <div>Backup Log Installation Process</div> <div>Please select your sql or gz.sql file for backup installation</div> <div><div>Log Table Spares</div><div>Select a Backup</div></div> <div><div>Select file</div><div>Choose File</div><div>No file chosen</div></div> <div>For backup installation you need to select backup from server or select from file.</div> <div><div>Load</div><div>Reset</div></div>

Figure 29: The log replacement functionalities

### 4.3 System Testing Results

The system developed modules were tested to check if they are working as required by the end-user. Table 3 below shows a summary of the system testing results.

**Table 3: System testing results**

<b>System Requirement</b>	<b>Test Score</b>
The system must allow system admin to register the users and manage them.	Pass
The system shall allow users to log in and logout if the username and password are correct	Pass
The system must allow the unregistered user do not have the access to use the system.	Pass
The system must allow the project manager to register projects and its members	Pass
The system shall allow the M&E officers to add/update the indicators	Pass
The system must allow the accountant to add/update the budget on the projects	Pass
The system should allow all successfully logged users to view the status of projects	Pass
The system should allow the project member to enter and upload the attachments	Pass
The system must allow users who have access to download the project report	Pass
The system should allow project manager/M&E officers to generate the projects reports	Pass
The system must allow the project manager, accountant and sponsors/partners to send or receive the feedback	Pass

### 4.4 User Acceptance Testing Results

To gather feedback from the system users, PMES was trained to the users and given three days to familiarize themselves. The users were then registered into the PMES for proceeding with using and interacting with the system in their different roles. In the project detail menu, the project manager was allowed to log in, reset the account, and register project details. In the project implementation menu, the M&E officer was allowed to login and add different project performance indicators. The accountant added the budget and sub-budget of the project activities, and the project member uploaded the attachment for activity which has been executed

and any needed details or explanation. The other functionalities in PMES were to view the list of projects with all associated details and status. After checking the requirements, the real users gave their opinion on the satisfaction of the PMES. This process was guided by a list of questions from which users selected either they strongly disagree, disagree, agree or strongly agree. The results were calculated on the mean score based on a four-point Likert scale (4 = Strongly Agree; 3 = Agree; 2 = Disagree and 1 strongly Disagree) as showed in Tab. 3.

**Table 4: The system's user acceptance validation result**

<b>Validation Features</b>	<b>Respondents</b>				<b>Mean Score</b>
	<b>Strong Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strong Agree</b>	
The PMES satisfies the requirements for M&E of the health projects	0	0	4	8	3.75
The PMES is easy to access	0	0	3	9	3.75
The interface of this PMES system is interactive	0	0	2	10	3.83
The system contents are learned, understand and easy to operate	0	0	3	9	3.75
The PMES will reduce the workload and paperwork in health projects	0	0	1	11	3.91
The PMES will improve health project data handling in a specific time	0	0	2	10	3.83
The PMES will improve the M&E process of the different health projects on time	0	0	3	9	3.75
The PMES will improve the report generation	0	0	4	8	3.67
The PMES will be useful and help in accessing the health project at the ministry	0	0	1	11	3.91
I think, I will continue using this PMES	0	0	0	12	4
I don't think there is a need for having training support to operate this system	0	0	1	11	3.91

From the study, the mean score for each validated feature was above 3.5 which indicates that the majority of respondents accepted the developed system, and they will be able to continue using it in their projects to improve the performance of project implementation and to achieve the goals of project plans. Lastly, they recommend using it or extended to fit other ministers/organizations M&E projects so as other ministries/organizations can simplify their M&E activities and equally benefit to the developed system.

## **4.5 Discussion**

This study has analyzed the M&E systems of various government projects at the MoHCDGEC in Tanzania. Based on the study findings, the MoHCDGEC currently relies on manual or paper-based systems in monitoring and evaluation of project activities, revealing a number of challenges in their operation such as poor information sharing and underperformance. Some previous studies indicate that there is a need for web-based tools to monitor and evaluate project activities, simplify data collection, easily share information among stakeholders and improve the performance of projects being implemented.

After system development, the system validation results indicate that the developed PMES will help to reduce the challenges presented and the results of user acceptance testing show that there is a need for PMES to be adopted at MoHCDGEC to minimize the manual works, improve cooperation among the ministry departments, stakeholders, donor fund and partners. Moreover, the proposed system will improve the quality of data, simplify the process of data collection and improve the progress of successful and well-performing projects at the ministry of health in Tanzania.



## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion**

This work studied how the ministry of health monitors and evaluates various project activities and proposes a web-based M&E system for improved project implementation and feedback mechanisms. The review of the current systems showed that despite the existence and use of data storage systems such as HMIS/DHIS, a number of challenges are still faced by MoHCDGEC in the current M&E system. These challenges include delay of data submission during project implementation and data loss which usually occurs between papers-based data collection to system data entry on a monthly or quarterly basis.

The developed web-based was found to be important to different stakeholders including project managers, project members and M&E officers in tracking the progress of health projects, together with decision-makers and policymakers in the health domain as a tool for better and informed decisions on various health projects.

#### **5.2 Recommendations**

To avoid having multiple systems doing the same tasks, projects should be based on government priorities. The presence of multiple systems is caused by the fact that donors of projects have their own systems for data collection and checking the progress of projects, eventually causing difficulties in M&E process. It is thus important that project donors align their priorities to the current government priorities in order to simplify and improve the M&E of all implemented health projects.

Harmonizing projects by using the electronic system will improve the implementation of M&E activities and increase the health benefits of all implemented projects. The system will also equipt staff with enough knowledge of M&E, reduce the time of M&E tasks and reduce unwanted data redundancies of the implemented health projects, and increase timely relay of M&E information. Therefore, the PMES is highly recommended to be used in all projects under the ministry of health for keeping track of implementation progress on successful and well-performing projects.

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## **APPENDICES**

### **Appendix I: Checklist questions during data collection**

#### **A. Focus group discussion for M&E officers**

1. What is the information needed during the registration of a new project?
2. What reporting system is currently being used to report routine health data projects at the Ministry
3. Who monitors the activities of the project?
4. Are stakeholders involved in M&E of the decision-making process?
5. Are stakeholders feedback sought during M&E processes?
6. What are the tools and techniques used to monitor and evaluate these projects at the ministry of health
7. How would you rate the applicability of these tools and techniques in the M&E process?
8. What other tools and techniques would you think can transpire the performance of the project report to success in the M&E system?
9. Do you have any challenges or difficulties in using the M&E system?
10. What do you think is contributing to the difficulty or challenge in M&E activities
11. What would you recommend to be done to improve the implementation of M&E?
12. In your opinion, would the use of a web-based M&E system on this project enhance the tracking of project activities?
13. In your opinion, would the use of a web-based M&E system on this project improve the progress monitoring?
14. What are the features you would like to see in a web-based M&E System to track the progress of projects at the ministry of health?

#### **B. Focus group discussion for ICT offices**

1. What the current system used to collect and manage data for different projects at the ministry of health?
2. What type of data format in the current system used to collect and keep data?
3. Do you retrieve and store data in the current system at the right time?
4. Which system used to report this data at the ministry



5. Do you have any challenges/problems in recording, keeping and managing this project's information?

**C. Interview for program members**

1. What are the methods of data collection?
2. Does this method of data collection are standard and report format are systematically used?
3. Do data collection and reporting tools are available and are they completely filled?
4. Do you report data as soon as possible after collection to the district level?
5. Do monthly, and quarterly reports are submitted to the district level and entered into DHIS by the specified deadline?
6. What other tools and techniques would you think can transpire the performance of the project report to success in M&E system?
7. Do you have any challenges or difficulties in using this tool/method for data collection and system to report?

## Appendix II: Checklist questions for user acceptance validation

Validation Features	Respondents				Mean Score
	Strong Disagree	Disagree	Agree	Strong Agree	
The PMES satisfies the requirements for health projects					
The PMES is easy to access the information that we will need					
The interface of this PMES system is interactive					
The system contents are learned, understand and easy to operate					
The PMES will reduce the workload and paperwork in health projects					
The PMES will improve health project data handling in a specific time					
The PMES will improve the M&E process of the different health projects on time					
The PMES will improve the report generation					
The PMES will be useful and help in accessing the health project at the ministry					
I think I will continue using this PMES					
I don't think there is a need for having training support to operate this system					

### Appendix III: Checklist questions for system testing results

No	System Requirement	Test score
1.	The system must allow <b>system</b> admin to register the users and manage them.	
2	The system shall allow users to login and logout if the username and password is correct	
3	The system must allow unregistered user do not have the access to use the system.	
4.	The system must allow project manager to register projects and its members	
5.	The system shall allow the M&E officers to add/update the indicators	
6.	The system must allow the accountant to add/update the budget on the projects	
7.	The system should allow all successfully logged users to view the status of projects	
8.	The system should allow the project member to enter and upload the attachments	
9.	The system must allow the users who have the access to download the project report	
10.	The system should allow project manager/M&E officers to generate the projects reports	
11.	The system must allow the project manager, accountant and sponsors/partners to send or receive the feedback	

### Appendix IV: Code for a login page

```
public function loginMe() {  
    $this->load->library('form_validation');  
    $this->form_validation->set_rules('email', 'Email',  
'required|valid_email|max_length[128]|trim');  
    $this->form_validation->set_rules('password', 'Password',  
'required|max_length[32]');
```

```

        if ($this->form_validation->run() == FALSE) {
            $this->index();
        } else {
            $email      =      $this->security->xss_clean($this->input-
>post('email'));
            $password = $this->input->post('password');
            $result = $this->login_model->loginMe($email, $password);
            if (count($result) > 0) {
                foreach ($result as $res) {
                    $lastLogin      =      $this->login_model-
>lastLoginInfo($res->userId);
                    $process = 'Login';
                    $processFunction = 'Login/loginMe';
                    $sessionArray = array(
                        'userId' => $res->userId,
                        'role' => $res->roleId,
                        'roleText' => $res->prp_position,
                        'name' => $res->name,
                        'lastLogin' => $lastLogin->createdDtm,
                        'status' => $res->status,
                        'isLoggedIn' => TRUE
                    );
                    $this->session->set_userdata($sessionArray);
                    unset($sessionArray['userId'],
                    $sessionArray['isLoggedIn'], $sessionArray['lastLogin']);
                    $this->logrecord($process, $processFunction);
                    redirect('/dashboard');
                }
            } else {
                $this->session->set_flashdata('error', 'Email address
or password is incorrect');
            }
        }
    }
}

```

```

        redirect('/login');
    }
}
}

```

## Appendix V: Code for indicator performance

```

function selectIndicatorPerformance($projectId=null) {
    $this->load->library('form_validation');

    $this->form_validation->set_rules('act_project_id',
    'Project Id', 'required');

    if ($this->form_validation->run() == FALSE) {
        redirect(selectProjectIndicatorPerformance);
    } else {
        $project_id = $this->input->post('act_project_id');
    }

    if(empty($project_id)){
        redirect('selectProjectIndicatorPerformance');
    }

    $project = $this->Project_Model->getProjectInfo($project_id);
    $ptitle = $project[0]->pro_title;

    $data['projectActivityInfo'] = $this->Activity_Model-
    >getProjectActivityInfoId($project_id);

    $data['ptitle'] = $ptitle;
    $data['projectId'] = $project_id;
    $data['action'] = 'addIndicatorPerformance';

    $this->global['pageTitle'] = 'PMES: Select Activity';

    $this->loadViews("selectActivity", $this->global, $data,
    NULL);
}

function addIndicatorPerformance($activityId = NULL) {

```

```

$this->load->library('form_validation');

$activity_id = 0;

if ($activityId == null) {
    $this->form_validation->set_rules('ind_act_id', 'Activity
Id', 'required');

    if ($this->form_validation->run() == FALSE) {
        $this->selectIndicatorAchievement();
    } else {
        $activity_id = $this->input->post('ind_act_id');
    }
} else {
    $activity_id = $activityId;
}

$activity = $this->Activity_Model-
>getActivityInfo($activity_id);

$data['activitydesc'] = $activity[0]->act_description;

$data['activityIndicatorInfo'] = $this->Activity_Model-
>getActivityIndicatorInfo($activity_id);

$data['activityId'] = $activity_id;

$indicators = $this->Activity_Model-
>getIndicatorPerformance($activity_id);

$performarr= [];

foreach ($indicators as $ind){
    $p = number_format($ind->ind_achievement/$ind-
>ind_target,2)*100;

    $performarr['label'][] = $ind->ind_object;
    $performarr['data1'][] = $ind->ind_target;
    $performarr['data2'][] = $ind->ind_achievement;
    $performarr['data3'][] = $p;
}

$data['chart_data'] = json_encode($performarr);

```

```

        //var_dump($perform);

        //exit();

        $this->global['pageTitle']      =      'PMES:      View      Indicator
Performance';

        $this->loadViews("addIndicatorPerformance",      $this->global,
$data, NULL);

    }

```

## Appendix VI: Code for upload activity attachment

```

function do_upload() {

    $config['upload_path'] = './uploads/';

    $config['allowed_types'] = 'pdf|gif|jpg|png';

    $config['max_size'] = 10000;

    //$this->global['allowed_types']=$config['allowed_types'];

    //$this->global['max_size']=$config['max_size'];

    $this->load->library('form_validation');

    $this->form_validation->set_rules('aca_activity_id', 'Activity
Description', 'trim|required');

    $this->form_validation->set_rules('aca_description',
'Attachment Description', 'required');

    $this->form_validation->set_rules('aca_location', 'Activity
Location', 'trim|required');

    $this->form_validation->set_rules('aca_facility', 'Attachment
Description', 'trim');

    $this->load->library('upload', $config);

    if (!((($this->upload->do_upload('aca_attachement')) && ($this-
>form_validation->run())))) {

        $this->global['upload_error']      =      $this->upload-
>display_errors();

        $this->uploadNewActivityAttachment();

    } else {

```

```

        $datav = $this->upload->data();

        $filename = $config['upload_path'] . $datav['file_name'];

        $currentDate = new DateTime();

        $curDate = $currentDate->format('Y-m-d H:i:s');

        $loggedEmail = $this->user_model->getUserEmail($this->vendorId);

        $data = array(

                'aca_activity_id' => $this->input->post('aca_activity_id'),

                'aca_attachement' => $filename,

                'aca_filetype' => $datav['file_type'],

                'aca_description' => $this->input->post('aca_description'),

                'aca_location' => $this->input->post('aca_location'),

                'aca_facility' => $this->input->post('aca_facility'),

                'createdOn' => $curDate,

                'createdBy' => $loggedEmail->email

        );

        $result = $this->ActivityAttachment_Model->addNewAttachment($data);

        if ($result > 0) {

                $process = 'Upload activity attachment';

                $processFunction = 'Manager/do_upload';

                $this->logrecord($process, $processFunction);

                $this->session->set_flashdata('success', 'Activity
Uploaded Successfully');

        } else {

                //print_r($datav);

                //echo '<br>' . base_url();

                $this->session->set_flashdata('error', 'Activity
Uploaded failed');

```



```
    }  
    redirect('uploadNewActivityAttachment');  
  }  
}
```